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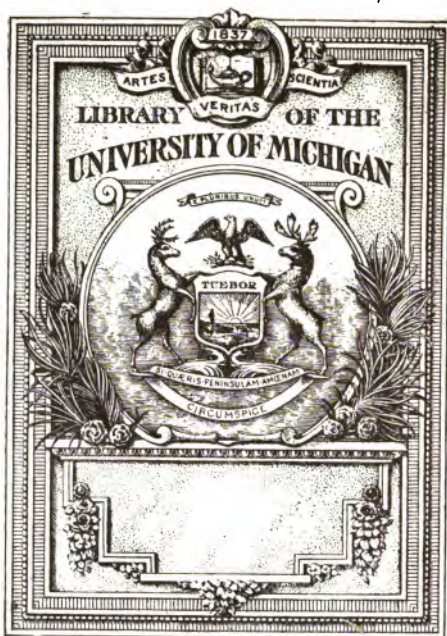
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*J. Hunter.*

# CONCISE SYSTEM OF ARITHMETIC,

*Peculiarly adapted to the use of Schools,*

IN TWO PARTS.

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BY A. MELROSE,

TEACHER, EDINBURGH.

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THE SECOND EDITION.

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M.DCC.XCV.

THE utility of Text-books is so obvious, that they are used in every department of Education. Their assistance is, perhaps, as necessary in teaching Arithmetic as in any other branch of science. A Teacher, who has the care of a numerous School, however great his abilities, will find it difficult to lead forward his pupils, with ease and propriety, without their aid. Nor will they be found of less advantage to the Scholar—each having one of his own, he has thereby an opportunity, when out of school, to commit any rule to memory, or perform any task his Teacher may assign him. With this view the present work is humbly offered.—The first part containing such a variety of Exercises as will enable the Teacher to give different questions to different pupils. The second part furnishing considerable assistance in their solution.—A low priced book on this plan, in the Author's opinion, was wanted; how far the present attempt is calculated to supply that defect, the public will determine.

Solution of question 6. in Arbitration of Exchange, omitted, by accident, in its proper place.

$$30 \text{ pence} = 1 \text{ crown}$$

$$1 \text{ flam. cr.} = 65 \text{ pence}$$

$$140 \text{ ducats} = 100 \text{ stamped crowns}$$

$$100 \text{ piaftres} = 100 \text{ ducats}$$

$$88 \text{ pen. gros} = 1 \text{ piaftre}$$

$$9100 \text{ crowns} = \text{how many pence gros}$$

$$\frac{30 \times 140 \times 100 \times 88 \times 9100}{65 \times 100 \times 100} \text{ by abbreviation} = 6 \times 140 \times 88 \times 7 =$$

$$517440 \text{ pence} = 12936 \text{ guilders.}$$

$$\text{Next, } 54 \text{ pence} : 1 \text{ crown} :: 517440 \text{ pence} : 9582\frac{2}{3} \text{ crowns.}$$

— of question 78. Miscellaneous questions.

$$\text{First, } \frac{231 \times 63 \times 62\frac{1}{2}}{1728} = \frac{909562\frac{1}{2}}{1728} = \text{lb, weight in a hhd.} = w.$$

Then the diameter of the wheel being = 48 in. the radius = 24 inches = D and 8 inches = d, therefore p =

$$\frac{909562\frac{1}{2}}{1728} \times \frac{8}{24} = \frac{909562\frac{1}{2}}{1728 \times 3} = 175.45 \text{ lb.}$$

# MULTIPLICATION TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

## T A B L E S.

*English money.* 4 farthings = 1 penny, 12 pence = 1 shilling, 20 shillings = 1 pound.

*Note,*  $\frac{1}{4}$  signifies 1 farthing,  $\frac{1}{2}$  1 halfpenny,  $\frac{3}{4}$  three farthings; also, a guinea = 21s, a crown = 5s, jacobus = 25s, moidore = 27s, joannes = 36s, angel = 10s, mark = 13s 4d, noble = 6s 8d.

2. *Avoirdupois weight.* 16 drams or dr. = 1 oz. 16 oz. = 1 pound, 28 lb. = 1 quarter, 4 qrs = 1 hundred weight, 20 cwt = 1 ton.

This weight is used for almost every thing in England, and in Scotland for leather, tallow, soap, groceries, &c.; and all goods brought from England.

3. *Troy weight.* 24 grains, or gr. = 1 pennyweight, 20 dwt = 1 ounce, 12 oz. = 1 lb. This weight is used for gold, silver, jewels, breads &c.

4. *Apothecaries weight.* 20 gr. = 1 scruple, 3 scr. = 1 dram, 8 dr. = 1 oz. = 12 oz. 1 lb.

5. *Clot's measure.*  $2\frac{1}{4}$  inches = 1 nail, 4 nails = 1 qr, 4 qrs = 1 yard, 3 qrs = 1 ell Flemish, 5 qrs = 1 ell English, 6 qrs = 1 ell French  $37\frac{1}{2}$  in. = 1 ell Scots.

6. *Long or lineal measure.* 3 barley-corns = 1 inch, 12 in. = 1 foot, 3 feet = 1 yard,  $5\frac{1}{2}$  yds = 1 pole, perch or rod, 40 poles = 1 furlong, 8 fur. or 1760 yds = 1 mile, 3 m. = 1 league.

7. *Square measure.* 144 inches = 1 foot, 9 feet = 1 yd, &c. *Solid measure.* 1728 inches = 1 foot, 27 feet = 1 yd, &c. *Land measure, English.*  $30\frac{1}{4}$  yds = 1 pole, 40 poles = 1

## T A B L E S.

rood, 4 roods = 1 acre. *Land measure, Scots.* 36 ells = 1 fall, 40 falls = 1 rood, 4 roods = 1 acre. Also, 100 links = 1 gunter's chain, 10000 links = 1 square chain, 100000 links or 10 chains = 1 acre. The English chain = 66 feet, the Scots chain = 74 feet.

3. *Wine measure.* 231 solid inches = 1 gallon. 2 pints = 1 quart, 4 qts = 1 gallon, 10 gal. = 1 anker, 18 gal. = 1 runlet,  $2\frac{1}{2}$  runlet or 42 gal. = 1 tierce, 2 tierce or 84 gal. = 1 puncheon,  $31\frac{1}{2}$  gal. = 1 barrel, 2 bar. or 63 gal. = 1 hoghead, 2 hhds = 1 pipe, 2 pipes = 1 ton.

*Ale and beer measure.* 282 solid inches = 1 gal. 2 pints = 1 quart, 4 qts = 1 gal. 8 gal. ale and 9 beer = 1 firkin, 2 firkins = 1 kilderkin, 2 kilderkin = 1 bar.  $1\frac{1}{2}$  barrel = 1 hoghead.

*Dry measure.* 2 pints = 1 quart, 4 qts = 1 gallon, 2 gal. = 1 peck, 4 pecks = 1 bushel, 8 bushels = 1 quarter.

*Time.* 60 thirds = 1 second, 60 sec. = 1 minute, 60 min. = 1 hour, 24 hours = 1 day, 365 days = 1 year, 365 days 6 hours = 1 julian year, 365 days 5 hours 48 min. 57 sec. = 1 solar year.

Note, That in the subsequent work, the following division (though not so accurate as the above) is sometimes used; 30 days = 1 month, 12 months = 1 year; 7 days = 1 week, 4 weeks = 1 month, 52 weeks = 1 year.

*Scots troy, or Dutch weight.* 16 drops = 1 oz. 16 oz. = 1 lb. 16 lb. = 1 stone.

*Troy weight* is the same as the above, only the pound varies in different places and for different purposes, from 20 to 28 ounce.

*Scots dry measure.* 4 lippies = 1 peck, 4 pecks = 1 firlo, 4 fir. = 1 boll, 16 bolls = 1 chaldar.

*Scots liquid measure.* 4 gills = 1 mutchkin, 2 mutch. = 1 choppin, 2 chop. = 1 pint, 2 pints = 1 quart, 4 qts = 1 gal.

### *Algebraic Characters.*

+, plus, the sign of addition. —, minus, the sign of subtraction. ×, sign of multiplication. ÷, sign of division.

Or division is sometimes represented by placing the dividend above, and the divisor below a line in the form of a vulgar fraction. ∴, ∷, the sign of proportion. Proportional numbers are stated and read as follows: 2 : 4 ∷ 3 : 6; that is, 2 is to 4 as 3 is to 6.

√ Square root.

∛ Cube root.

# ARITHMETIC.

**A**RITHMETIC is the science which treats of the properties of numbers, and the method of computing by them. Its fundamental rules are Notation, Numeration, Addition, Subtraction, Multiplication, and Division: The four last may be distinguished into simple and compound, according as the numbers concerned are of the same or of different names.

## NOTATION.

Notation teaches to express numbers by figures.

*The Figures are the ten following :*

1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

One, two, three, four, five, six, seven, eight, nine, cypher.

These may represent either Units, Tens, Hundreds, &c. according to the place in which they stand, as in the following Table :

Quintillions.	Quadrillions.	Trillions.	Billions.	Millions.	Hundreds of Thouf.	Tens of Thouf.	Thousands.	Hundreds.	Tens.	Units.
cxt cx	cxt cx	cxt cx	cxt cx	cxt cx	cxt cx	cxt cx	cxt cx	cxt cx	cxt cx	cxt cx
8. 074, 73 8.	577, 48 3.	890, 06 4.	871, 834. 7	1 4, 8 9 8						

Where it appears *1<sup>st</sup>*, that any figure standing in the first place represents so many Units, in the second so many Tens, &c. continually increasing in a tenfold proportion towards the left hand. *2<sup>dly</sup>*, That though the cypher is quite insignificant when standing by itself, or on the left hand of any number ; yet, placed on the right hand of any of the other figures, it increases their value ten times. Whence this

A

*Rule,*

## A D D I T I O N.

*Rule,* To write down any number in figures—Put the figures of the number in the *places* mentioned in it, and supply vacancies with cyphers.

### E X A M P L E S.

Write down in figures, four hundred and thirty-two—six hundred and seven—seven hundred and ninety—four thousand seven hundred and twenty—fifty-eight thousand and eight—one hundred thousand four hundred and four—seventy million—three hundred and thirty-three millions four thousand and four—nine billions—twenty-four trillions—three quadrillions—four quintillions—seven sextillions—three septillions—five octillions—two nonillions

## N U M E R A T I O N

Teaches to read any number expressed in figures.

*Rule,* Distinguish the number into periods, of six figures each, as in the Table, whereby the *places* of the several figures will readily appear; read them accordingly.

### E X A M P L E S.

Write in words, 7846—9107—834168—10000—9141600  
716800078—87141687001—8914168784141—801714678

## A D D I T I O N

Teaches to find a number equal to the sum total, or amount of two or more numbers.

### S I M P L E A D D I T I O N.

*Rule,* Write the given numbers under each other, so that units stand under units, tens under tens, &c.

Begin at the units column, find its sum; for every ten, in that sum, carry one to the next column; but first write the excess above the tens under the column added; proceed thus with every remaining column, till the last, under which write the whole sum.

*Proof.* Repeat the operation, beginning at the top.

### E X A M P L E S.

467894	8745678	93748657	69147873914
567891	3854953	58597478	25789094856
234567	6788495	7141637	73571408741
891416	6378964	815621	2147854734
745935	5916387	7891468	8784157854
874896	4859635	714876	73874998937
487493	8749638	89419675	22534567890
4270092			



4.  $91416874 + 9123456 + 7894 + 371869 + 71467854 + 98746$
5.  $9141687 + 91474 + 768746 + 741639 + 456789123 + 74869.$
6.  $8914681 + 71416866 + 6714168 + 7891234 + 5678901.$
7.  $8345678 + 901234 + 5678912 + 345678912 + 3456789.$
8.  $79141687 + 41789143 + 456789 + 123456 + 789123456.$
9.  $9714167914 + 8798754 + 91467857 + 34968748 + 3741689$   
 $+ 78963874 + 87891468 + 93417348 + 89148638.$
10.  $47141689648 + 38987491689 + 71467634168 + 71141638.$   
 $7489 + 714168748969487 + 1469148749 + 8914167896.$
11.  $714914768954 + 379142866786 + 871416874 + 711434 +$   
 $3714628416 + 7146891434567 + 914638 + 714169416941.$
12.  $911400714168 + 378984609187 + 8901234567 + 871416-$   
 $87689 + 714168714896 + 87145670123456 + 7890123456 +$   
 $789884462 + 7861023456 + 8948714687354 + 9141687489$   
 $+ 714896784359 + 9141687143 + 7149168748.$
13. A owes to B £. 8967, to C 7456, to D 7498, to E 7538, to F 78568, to G 91034, to H 9168. Required A's debt.
14. A Gentleman planted of Elms 7846, of Ashes 7384, of Firs 7889, of Oaks 718, of Birches 389, of Beeches 898. How many did he plant in all?
15. D borrowed of C at one time £. 348, at another 754, at another 137, and 785: How much has he borrowed in all
16. D has paid C at one time £. 934, at another 121, at another 515, and owes him still 454. What was D's debt?
17. The imports of Cotton-Wool into Britain for 1789 were as follows, viz. From Foreign West Indies *Libs* 239803, Turkey 4668231, East Indies 2101104, Domerary 1345702, French 6143623, Brazil 4755635, Spanish West Indies 93726, West Indies per Ireland 52794, Georgias 18964, Africa 1626, Bahamas 377980, Bermudas 5800, British 9998986, other parts 705921, into Scotland, from the British West Indies 1700000. Required the total imports anno 1789.
18. From the creation to the departure from Egypt was 2513 years; from thence to the building of Solomon's Temple 487; to the first olympiad 228; to the Jewish captivity 170; to their return 70; to the beginning of the Peloponnesian war 105; to Alexander's conquest of Persia 98; to the first Punic war 69; to the destruction of Carthage 118; to the Christian Æra 146; to the year 1790. Required the time from the creation.

## SUBTRACTION.

19. A Farmer laid out on Oxen £. 296; on Horses 413; on Sheep 754; on Cows 217; on Timber 87; on Iron 23; on Labouring-utensils 173; on Household-expences 33. Required his total disbursements.
20. Received from A seven hundred and sixty-four pounds, from B one thousand, from C fifty-five, from D eight hundred and one, from E one thousand and sixty-eight, from F eleven thousand eleven hundred and eleven, from G ten thousand one hundred and nine, from H five hundred and sixty pounds. How much did I receive in all?
21. From Edinburgh to Perth is 41 miles, from Perth to Brechin 42 m. from Brechin to Aberdeen 39 m. from Aberdeen to Banff 44 m. from Banff to Elgin 33 m. from Elgin to Inverness 38 m. Required, the distance of each of these towns, from each of the others.

## SUBTRACTION.

Teaches to find the difference of any two numbers, by taking the less from the greater. The greater is called the Minuend, the less the Subtrahend.

## SIMPLE SUBTRACTION.

*Rule.* Place the less number under the greater, units under units, tens under tens, &c. Beginning at units, take the first under figure from that above it, under which write the difference. Proceed thus with every remaining figure, except when an under figure exceeds its corresponding upper one, in which case, take the lower from ten, add the remainder to the upper figure, which sum set down as before; remembering to carry one to the next under figure, for the ten borrowed.

## EXAMPLES. \*

<i>Proof.</i> The sum of the Subtrahend & remainder, will be equal to the Minuend, if the work is right.	$\left. \begin{array}{l} \text{From} \\ \text{Take} \end{array} \right\}$	7486	Minuend.
		3795	Subtrahend.
		<u>3691</u>	Remainder.
		<u>7486</u>	Proof.

\* More examples may be taken from the two first lines of the examples in Addition.

1. A borrowed from B 6548*l.* of which he has since paid 1874. How much is A still due?
2. A was born anno 1739, B 1752. Required their ages?
3. C is now 57 years of age and D 69, when were they born?
4. A owes B 8118*l.* of which he has paid 789*l.* What is yet due?
5. A gentleman has of yearly rent 3113*l.* and pays 219*l.* feu-duty; what is his nett income?
6. A gentleman, just now living in Yorkshire, is aged 137 years; in what year was he born, this being anno 1790?
7. A person owes to A 437*l.* to B 981*l.* to C 988*l.* to D 754*l.* he has in cash 899*l.* in bills 1000*l.* How much will he require to pay off his debt?
8. A certain building was founded anno 1519, another 604 years sooner. How long is it since each of these events?
9. The Israelites departed from Egypt anno mundi 2513, and Solomon's Temple was built *a. m.* 3000. How many years elapsed between these events?
10. A bankrupt owed to A 436*l.* and compounded with him for 177*l.* to B 893*l.* but compounded with him for 379*l.* to C 1114*l.* but compounded for 539*l.* to D 1000*l.* but compounded for 467*l.* Required the bankrupt's total deficiency?
11. X borrowed 1781*l.* and paid 987*l.*; borrowed 1114*l.* paid 873*l.*; borrowed 891*l.*; paid at two different times 198*l.* How much does he still owe?
12. What is the difference betwixt one billion and 197848615.

## MULTIPLICATION

Teaches to find the amount of a number repeated as often as there are units in another: The first of these is called the multiplicand, the last the multiplier; and both of them are called factors. The amount of the number, so repeated or multiplied, is called the product.

### SIMPLE MULTIPLICATION.

*Rule 1.* To multiply by any number, write the multiplier under the multiplicand, units under units, tens under tens, &c.—Beginning at units, multiply the multiplicand by each figure of the multiplier successively, always observing to place the first figure of each product under the figure by which you are multiplying. Add these products.

A 3.

Note:

- Note 1. *If the multiplier is 12, or under, multiply by it at once.*  
 2. *If there be cyphers annexed to either or both factors, multiply by the significant figures, and annex the cyphers to the product. Whence, to multiply by an unit with cyphers, is only to annex the cyphers to the multiplicand.*

## EXAMPLES.

Multiply 67890314286759 by 6, 7, 8, 9, 10, 11, 12.

- |                    |                     |
|--------------------|---------------------|
| 1. 78460839X23     | 19. 56789015X7895   |
| 2. 809875465X34    | 20. 4839786X6005    |
| 3. 687496X46       | 21. 7376870X9764    |
| 4. 914749X58       | 22. 84684689X6785   |
| 5. 709635X69       | 23. 9487096X7089    |
| 6. 787496X47       | 24. 6945873X9807    |
| 7. 5789690X59      | 25. 78596439X93875  |
| 8. 9694098X68      | 26. 7894683X57864   |
| 9. 678457X74       | 27. 7146874X76948   |
| 10. 345678X85      | 28. 6846000X478400  |
| 11. 8912085X97     | 29. 7469400X6914000 |
| 12. 697485X100     | 30. 6785946X567890  |
| 13. 6789456X407    | 31. 7146087X7080040 |
| 14. 91468379X809   | 32. 879146X370854   |
| 15. 831097854X8934 | 33. 896385X66874    |
| 16. 574673889X5148 | 34. 378569X700000   |
| 17. 7896384X305    | 35. 3486000X850000  |
| 18. 6849645X704    | 36. 7146874X8191467 |

Rule 2. When the multiplier is the product of any two or more factors, neither of which exceeds 12, multiply successively by these factors.

- |               |              |                 |
|---------------|--------------|-----------------|
| 1. 7849687X18 | 5. 378548X14 | 9. 9146374X72   |
| 2. 679148 24  | 6. 919068 45 | 10. 8098345X108 |
| 3. 919078 33  | 7. 748969 84 | 11. 6786348X112 |
| 4. 871498 55  | 8. 487496 16 | 12. 9687685X168 |

1. A field contained 645 shocks of 12 sheaves each. Required the number of sheaves?
2. How many letters are there in a page containing 45 lines, each line 59 letters?
3. Ninety-six persons have a legacy divided among them, and the share of each is 354/. What was the legacy?
4. What is a gentleman's yearly income who has 36/. per week?

## DIVISION.

7

5. A gentleman gave his daughter a scrutoire in which was 12 drawers, each having 6 divisions, and in each division 134/. Quere the lady's fortune?
6. In a room 16 feet long and 14 feet broad; how many square feet?
7. How many stones, each a foot square, will lay a foot-path, half a mile long, and 7 feet broad?
8. How many grains of wheat will fill 987 bushels, when 1 bushel contains 675000?
9. How many strokes does the hammer of a clock strike in a year?
10. How many yds in a road 6 miles long, and 3 yds broad?

## DIVISION

Teaches to find how often one number is contained in another. The first of these is called the divisor, the other the dividend, and the number of times the divisor is contained in the dividend, is called the quotient.

### SIMPLE DIVISION.

*Rule,* To divide by any number, place the divisor on the left hand of the dividend, with a stroke between them. Find how often the divisor is contained in the fewest figures possible on the left of the dividend, put the figure expressing the number of times on the right of the dividend, with a stroke between them; multiply the divisor by it, place the product under the figures out of which it was taken, and subtract it from them, and to the remainder annex the next figure of the dividend; divide the number thus obtained in the same manner, and so on, until all the figures of the dividend are used.

*Note, 1.* If the product exceeds the figures it is to be subtracted from, the quotient figure is too large; if the remainder be equal to, or exceed the divisor, the quotient figure is too small.

2. If the divisor is 12, or under, the work may be performed mentally, and the quotient only put down.
3. If there are cyphers annexed to the divisor, point them off, and proceed without them, remembering to point off as many figures on the right of the dividend, which at last annex to the remainder; whence, to divide by an unit with cyphers, is only to point off, from the dividend, an equal number of figures.

### EXAMPLES.

## EXAMPLES.

Divide 7841687858 by 4, 5, 6, 7, 8, 9, 10, 11, 12.

- |                        |                             |
|------------------------|-----------------------------|
| 1. 23)107615827        | 18. 475)117594325           |
| 2. 17)8416836          | 19. 689)218860161           |
| 3. 26)8916084          | 20. 3746)10140103590        |
| 4. 46)3609198594       | 21. 5682)839106396          |
| 5. 59)477826524        | 22. 47269)3478100289        |
| 6. 74)6768701338       | 23. 3709)6349154            |
| 7. 58)4550728662       | 24. 8778)15678421           |
| 8. 79)67849168         | 25. 87146)78419678          |
| 9. 85)7774859645       | 26. 417396)318998232168     |
| 10. 89)349168748       | 27. 2719064)15359274703104  |
| 11. 97)8872486889      | 28. 67800)9774800000        |
| 12. 99)9055424763      | 29. 97000)1171454353000     |
| 13. 98)74869435        | 30. 8700)12709830000        |
| 14. 809)5502669904     | 31. 24600)68092800000       |
| 15. 456)41709581053824 | 32. 10746047)43521606407307 |
| 16. 305)2070784080     | 33. 804700625)166579474222  |
| 17. 897)72168551428    | 305625                      |

*Rule, 2.* When the divisor is the product of any two or more factors, not exceeding 12, divide successively by these factors.

*Note, To find the true remainder, multiply the last remainder by the first divisor, and to the product add the first remainder.*

- |              |                 |                  |
|--------------|-----------------|------------------|
| 1. 48)85536  | 5. 64)29304     | 9. 121)470867628 |
| 2. 72)149364 | 6. 81)835362    | 10. 99)747781056 |
| 3. 144)28552 | 7. 88)6908352   | 11. 72)56497608  |
| 4. 28)495368 | 8. 108)97994448 | 12. 168)10655400 |

1. Divide an assessment of 5340*l.* equally among 12 counties?
2. The number of letters in a quarto volume which contained 4465 in a page, were 3393400. How many pages and sheets were in it?
3. A plantation containing 10656 trees, consisted of 96 rows. How many were in each row?
4. A gentleman's income, *per annum*, is 788*l.* What is it *per week*?
5. The sum of 4824*l.* is to be raised from 12 counties, in each of which are six parishes. How much must be levied from each parish?
6. The area of a room 18 feet broad is 360 feet. Required its length?

7. Twenty-one casks contain 10941 herrings. How many are there in each cask?
8. A multiplier is 789, and product 6678885. Required the multiplicand?

*Proof,* The operations of multiplication and division being, in their nature and tendency, directly opposite to one another; the best method, perhaps, to prove multiplication, is to divide the product by either factor, the quotient will be the other factor, if the work is right. And to prove division, multiply the quotient by the divisor, adding the remainder (if any) and the product will be the same as the dividend.

## REDUCTION

Teaches to change one denomination into another, without altering its value, and is performed by multiplication and division.

*Rule,* To bring a greater name into a less,—Multiply.

To bring a less name into a greater,—Divide.

Always multiply and divide by the number of times, the less name is contained in the greater.

## EXAMPLES.

1. In 4678567 pounds, How many shil. pence, and farth?
2. In 47864 guineas, How many shil. pence, and farthings?
3. In 7846 crowns, How many sixpences and threepences?
4. In 87496 pounds, How many crowns and sixpences?
5. In 67l 18s 10½d, How many farthings?
6. In 17s 0½d, How many halfpence and farthings?
7. In 78468 guineas, How many shil. fourp. and twopences?
8. In 8416 half-guineas, How many sixpen. and halfpence?
9. In 4746 moidores, How many shil. groats, and halfpence?
10. In 7849 joannes, How many shil. threepences and pence?
11. In 78496 pounds, How many shil. groats, and halfpence?
12. In 6784l 18s 11½d, How many halfpence and farthings?
1. In 4491424320 farthings, How many pen. shil. and pounds?
2. In 48246912 farth. How many pence, shil. and guineas?
3. In 156920 threepences, How many sixpences and crowns?
4. In 3499840 sixpences, How many crowns and pounds?
5. In 65227 farthings, How many pence, shil. and pounds?
6. In 409 halfpence, How many pence, shil. and pounds?
7. In 9886968 twopences, How many fourp. shil. and guineas?
8. In 2120832 halfp. How many pen. sixp. and half-guin.?

9. In

9. In 3075408 halfp. How many groats, shil. and moidores?
10. In 6781536 halfp. How many threep. shil. and joannes?
11. In 37678080 halfp. How many groats, shil. and pounds?
12. In 6513550 far. How many halfp. pen. shil. and pounds?
1. In 46784, How many half-crowns, fixpen. and crowns?
2. In 78914, How many crowns, shillings and guineas?
3. In 914684 half-crowns, How many fixp. shil. and joannes?
4. In 9146783 half-guineas, How many fixp. and moidores?
5. In 714680 guineas, How many pounds and joannes?
6. In 87416835 joannes, How many crowns and fourpences?
7. In 73156780 moid. How many guineas and pounds?
8. In 41146788 groats, How many shil. and half-guineas?
9. In 43500/, How many shil. crowns, and pence?
10. In 4200 crowns, How many guin. shil. angels, and groats?
11. In 42 guin. 17s 8d, How many groats and half-crowns?
12. In 7465 joannes, How many pounds and guineas?
13. In 678498 jacobus', How many guineas?
14. In 46784966 pounds, How many nobles and marks?
15. In 784698460 jacobus', How many pounds and joannes?
16. In 526446 pounds, How many marks and nobles?
17. In 678498 nobles, How many pounds and quar. guineas?
18. In 4526457 marks, How many pounds and half-guineas?
19. In 7487 marks, How many twopences and crowns?
20. In 6784 pounds, How many crowns, half-crowns, and fixpences, and of each an equal number?
21. In 63498 quarter-guineas, How many nobles?
22. In 896328 half-guineas, How many moidores?
23. In 57385 crowns, How many half-crowns and marks?
24. In 3 purses, each 71 guineas, How many nobles?
25. In 640 joannes, How many crowns, shil. fixp. and twopences, and of each an equal number?
- § 1. In 1 ton. How many cwt, qrs, lb, oz, drs?
2. In 56 ton, 17 cwt, 3 qrs, 14 lib, 11 oz, 13 drs, How many drams?
3. In 34 cwt, 3 lib, 13 drs, How many drs?
4. In 3 qrs, 14 lib, How many ounces?
5. In 27 lib, 10 drs, How many drams?
6. In 14 ton, 15 oz, How many ounces?
7. In 674968749 oz, How many lib, qrs, cwt, ton?
8. In 914674 drs, How many oz, lib, qrs, cwt?
9. In 896784 drs, How many oz, lib, qrs, cwt?
10. In 98968 oz, How many lib, qrs?

11. In



11. In 478698 drs, How many oz, lib?
12. In 91474684 ounces, How many tons?
- § 13. In 1 lib, How many oz, dwt, grs?
14. In 484 lib, 11 oz, 17 dwts, 23 grs, How many grs?
15. In 974 lib, 13 dwt, How many grs?
16. In 11 oz, 21 grs, How many grs?
17. In 7 lib 8 oz, How many ounces?
18. In 15 lib 3 dwts, How many grs?
19. In 46080 dwts, How many oz, lib?
20. In 78968 grs, How many dwts, oz, lib?
21. In 4919187 grs, How many dwts, oz, lib?
22. In 437496 grs, How many oz?
23. In 74916874 ounce, How many lib?
24. In 39168744 grs, How many lib?
- § 25. In 1 pound, How many oz. dr. scr. and grs?
26. In 689 lib, 17 grs, How many grs?
27. In 784 lib, 4 oz, How many scruples?
28. In 786496 scruples, How many lib?
29. In 3741935 grs, How many lib?
30. In 9146874 drs, How many lib?
- § 31. In 7487 yds 3 qrs, How many nails?
32. In 49010 yds 2 qrs, How many inches?
33. In 4 yds, 2 qrs 3 nails, How many half-nails?
34. In 784680 nails, How many yards?
35. In 1764378 inches, How many yards?
36. In 9416874 half-nails, How many qrs?
37. In 78467 ells English, How many yards?
38. In 74875 ells Flemish, How many ells English?
39. In 79684 ells Flemish, How many yards?
40. In 914635 yds, How many ells English?
41. In 8768949 ells French, How many ells Flemish?
42. In 7469455 yds, How many ells Eng. and ells French?
- § 43. In 1 league, How many miles, furlongs, poles, yards, feet, inches, barley-corns?
44. In 78916480496 miles, How many yds?
45. In 3 leag. 2 mil. 6 fur. 7 inch. How many barley-cor.
46. In 47896840084 barley-corns, How many miles?
47. In 78914638914 yds, How many leagues?
48. In 30874968744 inches, How many miles?
- § 49. In 4678 acres, How many roods and perches?
50. In 578 acres 2 roods 17 pol. How many poles?
51. In 784 ac. 8 pol. How many yards?

52. In 478 acres 3 roods 18 falls, How many falls?
53. In 478964800 perches, How many acres?
54. In 987468946 poles, How many roods?
55. In 4874168498 yds, How many poles and roods?
56. In 4891467896 ells, How many acres?
- §57. In 294 square yds, How many feet and inches?
58. In 326592 square inches, How many feet and yds?
59. In 38 yds 64 inches, How many inches?
60. In 98624 inches, How many feet?
61. In 243 solid yds, How many feet and inches?
62. In 13856832 solid inches, How many feet and yds?
- §63. In 4786798948008 inches, How many gal. hhd. pun.
64. In 67849 puncheons, How many gal. and barrels?
65. In 5678496 pun. How many tierces and hhds?
66. In 134748 ankers, How many runlets?
67. In 7864 bar. beer, How many gall. and hhds?
68. In 8794 kilder. beer, How many gal. qts, and pints?
69. In 6784 hhds ale, How many hhds beer-measure?
70. In 6 hhds ale, How many bar. kil. fir. gal. pts?
71. In 4968 hhds beer, How many bar.?
72. In 4398 hhds ale, How many gal. and kil.?
73. In 10176 bar. ale, How many gal. qts, hhds?
74. In 7149168 pints ale, How many hhds?
- §75. In 784 qrs, 3 pecks, How many gallons?
76. In 200710 gallons, How many qrs?
77. In 4783 qrs. 7 bush. 3 p. 1 g. 3 qts, 1 pint, How many pints?
78. In 878468 pts, How many qrs?
- §79. In 1 year 11 m. 29 d. 23 h. 59 sec. How many sec.?
80. In a julian year, How m.ny hours?
81. In a solar year, How many thirds?
82. In 1 year, or 365 days, 6 hours, How many seconds?
83. In 11360497554 thirds, How many years?
84. How many seconds have elapsed since the commencement of the Christian Æra, this being 1790?

COM-

## COMPOUND ADDITION.

*Rule,* Write like names under each other. Begin with adding the lowest name, and for every one of the next higher, which that sum contains, carry 1 to the next name; but first write down the excess, if any, under the denomination added; proceed in this manner, through all the denominations till the last, at which carry at 10, as in Simple Addition.

*Note,* When a name consists of two lines, add as in Simple Addition, and find the carriage upon the slate; except that in carrying at 12, or at a multiple of 10, the carriage may be found mentally.

## EXAMPLES.

1. £. 9	8	10	2. £. 8	17	5	3. £. 94	15	5½	4. £. 816	17	8½
8	16	11	5	8	6½	87	16	6½	389	18	10½
7	8	3	7	4	4½	91	17	7½	31	17	11
8	16	2	-	19	4½	67	18	8½	346	18	6½
7	3	4	18	10	11	84	19	9½	407	13	8½
8	17	2	3	7	4	98	-	¼	748	11	11
3	8	11	5	12	7½	56	17	11	567	14	4½
6	9	2	8	19	2	133	3	10½	687	15	10½

5. £. 17846 17 8 + 3479 13 11 + 6783 14 5 + 687 15 10 + 8412 11 4 + 6791 15 7 + 6149 17 8 + 8416 11 3 + 879 18 4 + 7358 13 8.

6. £. 4738 17 2 + 3947 19 8 + 7135 13 - + 914 - 8 + 4783 15 11 + 7198 17 - + 8359 11 8 + 8746 - - + 879 8 7 + 9157 16 8.

7. £. 3109 - 11 + 798 13 4½ + 9146 13 7 + 874 - 8 + 9146 3 4 + 8749 13 5 + 8735 19 9 + 9146 17 8 + 874 13 4½ + 68 10 4½.

8. £. 7148 11 8½ + 3596 18 11½ + 71416 13 8½ + 81 11 4 + 7186 13 4½ + 714 13 8½ + 8196 18 10½ + 811 8 6.

9. £. 9148 11 9½ + 4937 10 10½ + 8719 11 10½ + 786 11 4½ + 91687 15 9½ + 87146 11 10½ + 6948 - 8½ + 91468 19 -½ + 9143 15 8½.

10. £. 87191 11 7½ + 81963 15 7½ + 81648 19 9½ + 7146 13 4½ + 9146 17 8½ + 9146 17 4½ + 87146 17 11½ + 9146 11 11 + 871416 13 9½.

## COMPOUND

ton.cwt.qr.	lib.oz.dr.	cwt.qr.lb.oz.dr.	lb.oz.dwt.gr.
11. 43 18 1	12. 23 15 13	13. 56 3 26 14 14	14. 58 11 15 18
31 15 3	21 14 15	11 2 27 15 13	46 8 17 17
71 16 2	8 — 13	3 1 18 13 12	8 7 18 15
52 17 1	15 13 —	16 1 21 10 11	4 4 19 18
7 13 3	6 11 —	82 2 24 11 15	77 5 16 21
6 14 3	7 8 7	6 3 25 12 11	6 7 13 23
8 15 3	8 7 10	4 3 21 13 12	84 8 12 22
59 16 1	24 15 11	9 2 17 14 13	5 9 11 14

lib.oz.dwt.gr.	lb.oz.dr.fc.gr.	yd.qr.n.	le.m.f.p.
15. 11 3 17 11	16. 4 11 7 2 11	17. 8 3 1	18. 4 2 7 19
5 11 15 15	3 5 1 1 19	5 1 2	4 1 3 27
16 5 16 18	7 — 4 2 4	13 — 1	8 1 4 35
17 10 17 21	8 — 3 2 —	5 — 3	7 — 5 39
18 8 18 23	9 6 — — 1	6 2 2	4 — 6 18
1 — 19 11	8 10 — 1 3	7 2 2	7 — 7 17
15 11 19 10	7 2 5 1 2	8 3 3	6 2 5 15

p.yd.ft.in.	ac. r. p.	ac. r. p. yd.	qr.b.peck
19. 15 4 2 11	20. 18 3 18	21. 7 1 18 15	22. 14 1 3
13 5 — 3	15 1 39	5 3 19 29	13 7 1
14 3 — 4	16 2 38	8 — 17 18	14 3 2
18 2 2 9	18 — 28	18 — 38 28	13 4 2
25 5 — 8	24 3 27	3 3 39 4	11 5 —
29 4 1 11	25 3 19	4 2 15 7	12 6 3

ton.hd.g.pt.	hhd.g.pt.	hhd.g.qt.pt.	days h. m.
23. 8 1 54 3	24. 9 5 1 3	25. 7 43 2 1	26. 243 18 40
7 3 59 1	3 53 7	4 47 3 1	198 23 59
4 — 62 7	9 52 1	16 45 1 —	214 13 41
8 — 15 5	8 51 4	4 21 3 1	34 — 22
3 2 39 6	5 21 2	3 25 2 1	29 21 —

*Examples of Scots Weights and Measures.*

ft. lb.oz. dr.	ac. r. f. el.	ch. b. fir.	gal.pt.m.gi.
27. 15 8 13 15	28. 8 1 2 9	29. 8 14 2	30. 4 3 3 1
14 15 14 13	7 1 9 18	7 15 3	3 7 1 3
13 7 15 3	3 1 3 19	8 13 —	8 4 2 1
8 — — 14	4 2 7 7	4 14 1	7 6 1 2
12 2 11 —	6 1 4 4	6 — 3	6 3 2 2
18 7 3 15	9 1 7 19	9 12 3	4 2 1 3

31. A owes to B 475*l* 18*s* 11*d*, to C 748 18 9½, to D 37 19 8½, to E 974 19 0½, to F 14 6 0½, to G 18 0 11, to H 1984 17 0, K 15 0 6½. Required A's debt?
32. A Merchant has in cash 148*l* 17*s* 8*d*. Wine to the value of 718 11 8. Rum 398 18 5½. Brandy 178 19 11. Gin 918 13 11. Tea 518 11 11. Sugar 315 19 8½. Various other goods 317 19 8. Required his stock?
33. A Woollen-Draper has in his shop, of blues 314 yards, 3 quarters 2 nails, of blacks 204 yds 3 n. of browns 654 yds 2 qr. 3 n. of scarlets 71 yds 1 qr. 2 n. of mixtures 854 yds, of various other colours 763 yds 3 nails. Required how much he has in all?
34. A Servant went to market and laid out on Tea 2*l* 4*s* 8½*d*, on Coffee 1*l* 5*s* 8½*d*, on Sugar 3*l* 17*s*, on Beef 1*l* 7*s*, on Mutton 36*s*, on Veal 7*s*, on various other articles 29*s*. How much was laid out in all?
35. A bankrupt owed to one of his creditors 784*l* 18*s* 11½*d*, to another 315*l* 17*s* 8*d*, to another 88*l* 0*s* 11¼*d*, to another 778*l* 15*s* 8*d*, to another 785*l* 17*s* 11½*d*, to another 13*l* 8*s* 6½*d*, to another 57*l* 18*s*, to another 318*l*, to another 154*l* 11*d*. Required his whole debt?
36. J carried to market 437*l* 18*s* 10*d*, and received there from A 54*l* 8*s* 8*d*, from B 78*l* 13*s* 9*d*, from C 34*l* 8*s*, from D 87*l* 8*s* 10*d*, from E 54*l*, from F 18*s* 10½*d*, from G 13*s* 11¼*d*, from H 15*l* 18*s* 0¼*d*. How much had J in all?
37. A collector drew in January 67*l* 18*s* 8*d*. Feb. 63*l* 14*s* 9*d*. March 94*l* 18*s*. April 93*l* 19*s*. May 108*l* 17*s* 11*d*. June 118*l* 13*s* 6½*d*. July 99*l* 13*s* 6½*d*. August 73*l* 19*s* 9½*d*. Sept. 53*l* 15*s* 9*d*. Oct. 68*l* 0*s* 11*d*. Nov. 48*l* 18*s* 10*d*. Decem. 73*l* 11*s* 8*d*. How much did he collect during the year?
38. A merchant has in cash 99*l* 8*s* 6*d*. Broad cloth, value 342*l* 18*s*. Narrow ditto 224*l* 14*s* 8*d*. Serges 13*l* 7*s* 8½*d*. Shalloons 18*l* 17*s* 11½*d*. Flannels 12*l* 11*s* 7½*d*. Thread 2*l* 6*s* 9½*d*. Buckram 4*l* 19*s* 11½*d*. Hose 17*l* 18*s* 9*d*. Stockings 18*l* 17*s* 8*d*. Hats 21*l* 19*s* 6*d*. House and shop 221*l*. Also, A owes him *per* bond 888*l*, B *per* ditto 756*l*, C 374*l*. M *per* account 23*l* 18*s* 11*d*, N 14*l* 18*s* 6*d*, P 56*l* 19*s* 5*d*, Q 73*l* 14*s* 9*d*, R 13*l* 18*s*, S 17*s* 8½*d*, T 1*l* 6*s* 8½*d*, W 19*s* 11¼*d*, X 13*s* 4*d*, Y 15*s* 8*d*, Z 18*l* 14*s* 10*d*. Required his stock?
39. Required the amount of the following sums, due by a

- certain Bank, *viz.* to A 687/ 17s 11½*d.*, to B 677/ 18s 10½*d.*, to C 345/ 14s 9½*d.*, to D 789/ 15s 8*d.*, to E 467/ 16s 7½*d.*, to F 912/ 17s 4*d.*, to G 456/ 18s 6½*d.*, to H 891/ 19s 8½*d.*, to K 345/ 10s 7½*d.*, to L 789/ 18s 4*d.*, to M 234/ 14s 9½*d.*, to N 678/ 15s 6*d.*, to O 123/ 16s 4½*d.*, to P 567/ 7s 8*d.*, to Q 912/ 18s 9½*d.*
40. The produce of a Sugar plantation for 16 years was as follows: Year 1<sup>st</sup>, 687 cwt. 3 qr, 27 lb. 15 oz. 14 drams. —2<sup>d</sup>, 958 1 26 13 15. —3<sup>d</sup>, 436 2 24 14 13. —4<sup>th</sup>, 891 1 25 13 15. —5<sup>th</sup>, 648 3 27 13 14. —6<sup>th</sup>, 168 1 23 14 13. —7<sup>th</sup>, 734 2 2 15 14. —8<sup>th</sup>, 687 2 22 13 13. —9<sup>th</sup>, 434 2 23 10 13. —10<sup>th</sup>, 578 3 19 11 15. —11<sup>th</sup>, 916 1 18 12 14. —12<sup>th</sup>, 876 1 14 13 12. —13<sup>th</sup>, 914 3 15 14 14. —14<sup>th</sup>, 768 1 16 15 13. —15<sup>th</sup>, 696 3 13 14. —16<sup>th</sup>, 768 1 14 14 14. Required the total produce?
41. A builder paid for ground to build a house 250*l.*, Mason's bill 424/ 17s 6*d.* Carpenter's 621/ 15s 9*d.*, Slater's 210/ 13s 4*d.*, Smith's 17/ 18s 9*d.*, Glazier's 74/ 18s 11*d.* Required at what he can sell it to gain 150*l.* by it?
42. A Gentleman is possessed of silver-plate, *viz.* Spoons, weight, 11 lb. 11 oz. 19 dwt. 22 grs. Teapot 3 lb. 9 oz. 17 dwt. 19 grs. Knives and forks 5 lb. 10 oz. 15 dwt. Salts 3 lb 17 dwt. 13 grs. Salvers 11 lb. 11 oz. 23 grs. Tankards 11 lb. 11 oz. 19 dwt. 22 grs. Vases 28 lb. 3 oz., 17 dwt. 15 grains. Required the total weight of his plate?
43. Required the content of a gentleman's estate, consisting of the following farms: *viz.* 1<sup>st</sup>, 467 acres 3 roods 18 pol. 2*d.*, 678 2 27. 3*d.*, 876 3 37. 4<sup>th</sup>, 678 3 39. 5<sup>th</sup>, 326 1 33. 6<sup>th</sup>, 146 3 34. 7<sup>th</sup>, 47 1 21. 8<sup>th</sup>, 89 2 34. 9<sup>th</sup>, 17 1 31. 10<sup>th</sup>, 147 3 15. 11<sup>th</sup>, 134 2 37. 12<sup>th</sup>, 108 acres 2 roods 4 poles?
44. From London to Hatfield is 20 miles 1 furlong 14 p. 3 yds, from thence to Bigliffswade 26 m. 1 fur. 4 p. ¼ yd, from thence to Stilton 30 miles 19 p. from thence to Colesworth 28 m. 15 p. 3 yds, from thence to Newark 22 m. 1 fur. 2 p. 1 yd, from thence to Doncaster 37 m. 1 f. 7 p. 2 yds, from thence to York 37 miles 12 p. 1 yard. Required the distance from London to York, and from each of these towns to each of the rest?

## COMPOUND SUBTRACTION.

*Rule,* Write like names under each other. Begin at the lowest name, and subtract the numbers of each name in the subtrahend from their like names in the minuend, borrowing in any name at the number of times it is contained in the next greater.

## EXAMPLES.\*

From £.	784	18	11	Cwt.	623	1	21	13	11
Take	358	14	5		435	2	27	14	15

1. A Merchant has in cash 474<sup>l</sup> 8s 9d. Goods, value 3443<sup>l</sup> 15s. A house 713<sup>l</sup> 11s. A ship 574<sup>l</sup>, another 315<sup>l</sup>. Debts due to him 957<sup>l</sup> 18s 11½d. He owes to A 115<sup>l</sup> 7s 8d, to B 327<sup>l</sup> 18s 4¼d, to C 74<sup>l</sup> 13s 4d. Required his nett stock?
2. A borrowed from B, at sundry times, the following sums, viz. 781<sup>l</sup> 63<sup>l</sup> 15s 52<sup>l</sup> 10s 565<sup>l</sup>; and has paid as follows, at different times in cash 330<sup>l</sup> 10s, 54<sup>l</sup> 13s 4d, 67<sup>l</sup> 10s, in goods 54<sup>l</sup> 18s 6d, 73<sup>l</sup> 15s 8d, by a draught on John Steel 63<sup>l</sup>. What is A still due?
3. A bankrupt owed to one of his creditors 678<sup>l</sup> 18s 10d, to another 773<sup>l</sup> 17s 6d, to a third 541<sup>l</sup> 17s 6½d. 4th, 168<sup>l</sup> 18s 8d. 5th, 764<sup>l</sup> 13s 4d. 6th, 987<sup>l</sup> 14s. 7th, 896<sup>l</sup> 19s. 8th, 871<sup>l</sup> 17s 8d. 9th, 173<sup>l</sup> 17s 11d. 10th, 999<sup>l</sup> 15s. 11th, 479<sup>l</sup> 16s 9d. His effects were as follows: Debts due to him by A 217<sup>l</sup> 8s 8d, by B 113<sup>l</sup> 17s 9d, by C 434<sup>l</sup> 8s 9d, by D 454<sup>l</sup> 16s 8d, by E 137<sup>l</sup> 19s 6d, by F 73<sup>l</sup> 18s 10½d, by G 64<sup>l</sup> 11s 8d, by H 206<sup>l</sup> 13s 11d, a house 350<sup>l</sup>, two more, each 546<sup>l</sup>, furniture, 215<sup>l</sup> 18s 11d, cloth, value 213<sup>l</sup> 14s 8d, linen 313<sup>l</sup> 8s, tea, in three lots, for 33<sup>l</sup> 18s 10d 44<sup>l</sup> 18s 11d 96<sup>l</sup> 17s 8d, port wine 4 hhds at 19<sup>l</sup> 13s each. Required a state of his affairs?
4. A merchant has in cash 146<sup>l</sup> 18s 11d, in goods, viz. cloth, value 212<sup>l</sup> 14s 6d, linen 311<sup>l</sup> 4s, cambrics and lawns 256<sup>l</sup> 14s 6d, muslins 217<sup>l</sup> 19s 11d, silks 314<sup>l</sup> 18s, cottons 178<sup>l</sup> 13s 8d, stockings 73<sup>l</sup> 14s 6d, hats 87<sup>l</sup> 13s 11d, gloves 24<sup>l</sup> 13s 9d, house and shop 256<sup>l</sup>. A owes him 737<sup>l</sup> B 113<sup>l</sup> 8s, C 56<sup>l</sup> 13s 11d.—He owes as follows: viz. To four wholesale dealers 156<sup>l</sup> 10s 9d, 297<sup>l</sup> 17s 11d, 384<sup>l</sup> 16s 8d, 21<sup>l</sup> 17s 7d, to three manufacturers 38<sup>l</sup> 18s 4d, 47<sup>l</sup> 15s 11d, 33<sup>l</sup> 15s 5d. Also, to M 13<sup>l</sup> 6s 6d, to N 25<sup>l</sup> 4s 6d.

\*Take more examples from the two first lines of those in Addition.

to P 17l 18s 10d, to Q 15l 10s, to R 23l 17s 11d, to S upon bond 155l. Required his nett stock?

5. A goldsmith purchased silver, viz. From A 25 lb. 10 oz. 13 dwt. from B 13 lb. 15 grs, from C 19 lb. 8 oz. 19 dwt. 23 grs, from D 14 lb. 8 dwt. 22 grs, from E 16 lb. 11 oz. 15 grains; of which he made into tea-spoons 31 lb. 18 grs; knives and forks 21 lb. 10 dwt.; four teapots, each 3 lb. 2 oz. 15 dwt. 13 grs. Sold at three different times 13 lb. 4 oz. 15 dwt. 3 lb. 14 dwt. 22 grs. 8 lb. 16 dwt. 19 grs. Required how much he had remaining?
6. A gentleman gave a silversmith 32 lb. of silver to make into knives and forks, weight 7 lb. 15 dwt., three vases, each 4 lb. 11 oz. 12 grs, spoons 6 lb. 5 oz. 13 dwt. 15 grs. salvers 1 lb. 2 oz. 14 dwt. 18 grs, the rest to be made into a punch bowl. Required its weight?
7. A merchant bought 3 hhds of sugar, each 4 cwt. 3 qrs. 16 lb. of which he retailed as follows: viz. 2 cwt. 13 lb. 1 cwt. 2 qr. 18 lb. 15 dr. 3 cwt. 3 qr. 27 lb. 15 dr. 3 qr. 17 lb. 12 dr. 23 lb. 15 dr. 15 lb. 13 oz. 14 dr. 17 lb. 11 oz. 15 dr. 2 cwt. 16 lb. 11 oz. 12 dr. How much had he on hand?
8. A trader owed to A 357l 18s 10½d, of which he has paid 249l 19s 11¼d, to B 287l 18s, of which he has paid 198l 19s 11d, to C 487l 19s, paid 298l 13s 8¼d, to D 78l 17s 9d, paid 39l 18s 11¼d, to E 59l 13s 6d, paid at three different times 13l 15s 6d, 17l 11s 3d, 19l 8s 11d. How much is the trader still due to each, and to the whole?
9. A gentleman has an estate of 3465 acres, he farms off to A 463 ac. 2 r. 14 pol., to B 146 ac. 3 r. 15 p., to C 713 ac. 1 r. 17 pol., to D 831 ac. 37 pol., to E 547 ac. 38 poles, to F 496 acres 3 roods 39 poles. How much remains in his hand?
10. A Wine merchant bought 47 hhds 17 gal. of wine; sold 13 hhds 8 gal. 7 pts; bought 33 hhds 38 gal. 5 pts; sold 44 hhds 47 gal. 3 pts; bought 54 hhds 19 gal. 3 pints; sold 45 hhds 62 gal. 7 pts; bought 96 hhds 43 g. 2 pts; sold 57 hhds 13 gal. 6 pts; bought 23 hhds 57 gal.; sold 45 hhds 2 g. 4 pts; bought 91 hhds 54 gal. 6 pts; sold 34 hhds 18 gal. 5 pints. Required the quantity remaining unfold?
11. A brewer has in his cellar 173 hhds 17 gal. of beer, of which he sent to six customers as follows: viz. 1½, 17 hhds



- 15 gal. 5 pts. 2*d*, 2 hhds 53 gal. 7 pts. 3*d*, 21 hhds 13 gal. 4 pts. 4*th*, 23 hhds 14 gal. 3 pts. 5*th*, 12 hhds 18 g. 3 pts. 6*th*, 15 hhds 51 gal. 7 pints: By this time he had brought into his cellar 24 hhds more; and sent to three more of his customers 7 hhds 39 gal. 5 pts each. How much remained in his cellar after these transactions?
12. A collector of cefs gave receipts to one part of his district for 304*l* 18*s* 8*d*, to another for 256*l* 13*s* 4*d*, to another for 417*l* 18*s* 11½*d*, to another for 784*l* 18*s*, to another for 964*l* 13*s* 9*d*, to another for 1000*l*, to another for 98*l* 17*s* 10½*d*, to another for 294*l* 18*s* 11*d*. His own salary was 140*l*; he paid three clerks 40*l*, 30*l*, 25*l*; to six sub-collectors, each 35*l*. Quere the nett revenue?
13. A state of X's debts is as follows: To A, on bond, 756*l* 18*s* 10*d*, with interest 42*l* 18*s* 6*d*; of which he has paid 378*l* 15*s* 10*d*, to B 456*l* 18*s* 8*d*, interest 23*l* 18*s* 4*d*; of which he has paid 208*l* 14*s*, to C 574*l* 10*s* 8*d*, interest 37*l* 10*s* 10*d*, paid 318*l* 17*s* 8*d*, to D 517*l* 4*s* 6*d*, paid 113*l* 11*s* 9*d*, to E 377*l* 19*s* 11*d*, interest 17*l* 19*s*, paid 137*l* 10*s* 6*d*, to F 391*l* 10*s*, interest 31*l* 17*s* 10*d*, to G 474*l* 17*s* 9½*d*, interest 94*l* 7*s* 8*d*, paid 191*l* 19*s* 11*d*, to H 577*l* 11*s* 8*d*, interest 35*l* 17*s* 9½*d*, of which he has paid 398*l* 17*s* 9*d*, to K 1000*l*, interest 50*l*, paid 273*l* 17*s*. Required how much money X will want to clear his debts?
14. Required the nett weight of 8 hhds tobacco, qt. No 1*st*. 8 cwt. 3 qr. 14 lb. tare 3 qr. 17 lb. No 2*d*. 7 cwt. 2 qr. tare 3 qr. 11 lb. No 3*d*. 5 cwt. 1 qr. 16 lb. tare 2 qr. 26 lb. No 4*th*. 9 cwt. 1 qr. 7 lb. tare 3 qr. 27 lb. No 5*th*. 8 cwt. 1 qr. tare 3 qr. 5 lb. No 6*th*. 4 cwt. 3 qr. tare 1 qr. 7 lb. No 7*th*. 6 cwt. 2 qr. tare 2 qr. 27 lb. No 8*th*. 7 cwt. 3 qr. 18 lb. tare 2 qr. 22 lb.
15. Eight hhds of sugar weigh as follows: No 1*st*. 27 cwt. 3 qr. 14 lb. tare 1 cwt. 13 lb. No 2*d*. 37 cwt. 27 lb. tare 1 cwt. 3 qr. 8 lb. No 3*d*. 21 cwt. tare 1 qr. 27 lb. No 4*th*. 43 cwt. tare 1 cwt. 1 qr. 19 lb. No 5*th*. 17 cwt. 18 lb. tare 2 qr. 20 lb. No 6*th*. 19 cwt. 1 qr. 5 lb. tare 26 lb. No 7*th*. 47 cwt. tare 1 cwt. 3 qr. 25 lb. No 8*th*. 44 cwt. 2 qr. 17 lb. tare 1 cwt. 17 lb. Required the nett weight of each hhd, and the gross, tare, and the nett weight of the whole?

## COMPOUND MULTIPLICATION.

**Rule 1.** When the multiplier is 12, or under, write the multiplier under the lowest name of the multiplicand. Multiply its several denominations in succession, beginning at the lowest; and carry as in Addition.

## EXAMPLES.

- |   |   |  |
|---|---|--|
| 1. $\text{£} \cdot 4 \text{ } 6 \text{ } 7\frac{1}{2} \times 3$ | 7. $13 \text{ } 5 \text{ } 7\frac{1}{2} \times 10$  | 13. $70 \text{ } 0 \text{ } 11\frac{1}{2} \times 12$ |
| 2. $9 \text{ } 8 \text{ } 4\frac{1}{4} \times 4$                | 8. $— \text{ } — \text{ } 4\frac{1}{4} \times 11$   | 14. $73 \text{ } 0 \text{ } 8 \times 11$             |
| 3. $74 \text{ } 18 \text{ } 11\frac{1}{2} \times 6$             | 9. $15 \text{ } 0 \text{ } 7\frac{1}{2} \times 4$   | 15. $— \text{ } 19 \text{ } 8 \times 10$             |
| 4. $— \text{ } 17 \text{ } 3\frac{3}{4} \times 7$               | 10. $17 \text{ } 8 \text{ } 0\frac{1}{2} \times 5$  | 16. $54 \text{ } 13 \text{ } — \times 9$             |
| 5. $18 \text{ } — \text{ } 11 \times 8$                         | 11. $— \text{ } 9 \text{ } 7\frac{1}{2} \times 7$   | 17. $73 \text{ } 17 \text{ } 8\frac{1}{4} \times 11$ |
| 6. $17 \text{ } 15 \text{ } 0\frac{1}{2} \times 9$              | 12. $18 \text{ } — \text{ } 4\frac{1}{2} \times 11$ | 18. $57 \text{ } 19 \text{ } — \times 12$            |
- 
- |   |  |
|---|--|
| 1. 7 cwt. 2 qr. 18 lb. $\times 9$         | 10. 7 bush. 3 p. 2 pts $\times 3$        |
| 2. 15 lb. 13 oz. 5 dr. $\times 11$        | 11. 74 hhds 47 gal. ale, $\times 8$      |
| 3. 18 lb. 3 oz. 14 dwt. 3 gr. $\times 12$ | 12. 3 y. 5 m. 29 days $\times 9$         |
| 4. 74 lb. 11 oz. 5 dr. 2 sc. $\times 12$  | 13. 2 days 3 ho. 59 m. $\times 10$       |
| 5. 37 ton 15 cwt. 2 qr. $\times 4$        | 14. 14 ac. 3 r. 39 p $\times 9$          |
| 6. 15 lb. 13 oz. 3 dr. $\times 5$         | 15. 8 ac. 2 r. 14 p $\times 11$          |
| 7. 13 lb. 3 oz. 8 dwt. 5 gr. $\times 6$   | 16. 365 d. 5 h. 48 m. 57 se. $\times 12$ |
| 8. 54 m. 3 fur. 18 p. 3 yds $\times 7$    | 17. 84 hhds 17 gal. alex $\times 11$     |
| 9. 49 hhds wine 13 gal. $\times 8$        | 18. 55 hhds 19 g. 5 pts be. $\times 12$  |

**Rule 2.** When the multiplier exceeds 12, and is the product of any two or more factors, neither of which exceeds 12; multiply successively by these factors.

- |   |   |   |
|---|---|---|
| 1. $63 \text{ } — \text{ } 8\frac{1}{2} \times 18$  | 8. $15 \text{ } — \text{ } 8 \times 30$               | 15. $7 \text{ } 8 \text{ } 11\frac{1}{4} \times 88$                 |
| 2. $17 \text{ } 11 \text{ } 8\frac{1}{2} \times 20$ | 9. $13 \text{ } 15 \text{ } 11\frac{1}{2} \times 42$  | 16. $8 \text{ } 8 \text{ } — \times 108$                            |
| 3. $13 \text{ } 17 \text{ } 0\frac{1}{2} \times 36$ | 10. $17 \text{ } 4 \text{ } — \times 48$              | 17. $19 \text{ } 11 \text{ } 4 \times 144$                          |
| 4. $27 \text{ } 18 \text{ } — \times 45$            | 11. $54 \text{ } 13 \text{ } 0\frac{1}{2} \times 50$  | 18. $17 \text{ } 5 \text{ } — \times 168$                           |
| 5. $— \text{ } 17 \text{ } 11\frac{1}{2} \times 56$ | 12. $— \text{ } 19 \text{ } 11\frac{3}{4} \times 84$  | 19. $37 \text{ cwt } 3 \text{ q. } 16 \text{ lb. } \times 15$       |
| 6. $— \text{ } — \text{ } 10\frac{1}{2} \times 72$  | 13. $15 \text{ } 18 \text{ } 11\frac{1}{2} \times 16$ | 20. $17 \text{ lb. } 15 \text{ dr. } \times 24$                     |
| 7. $23 \text{ } 15 \text{ } — \times 24$            | 14. $37 \text{ } 7 \text{ } — \times 36$              | 21. $21 \text{ lb. } 13 \text{ dwt. } 17 \text{ grains } \times 77$ |

**Rule 3.** When the multiplier is not the product of any two or more factors—First, Multiply, *as in the last case*, by two such factors as come nearest the given multiplier; next, by what these factors want of that multiplier. Add these products.

- |                    |                            |       |                             |        |                  |
|--------------------|----------------------------|-------|-----------------------------|--------|------------------|
| 1. $\mathcal{L}.3$ | 7 $0\frac{1}{2} \times 17$ | 6. 77 | 18 $0\frac{1}{2} \times 59$ | 11. 62 | 13 $8 \times 58$ |
| 2. 4               | $- 3\frac{1}{2} \times 23$ | 7. 63 | 17 $8 \times 19$            | 12. 18 | 19 $- \times 61$ |
| 3. 7               | $- \frac{1}{2} \times 41$  | 8. 53 | 13 $8\frac{1}{2} \times 39$ | 13. 77 | 13.4 $\times 68$ |
| 4. -               | 7 $8\frac{1}{2} \times 51$ | 9. -  | 14 $8\frac{1}{2} \times 47$ | 14. 33 | 4 $6 \times 74$  |
| 5. 18              | 11 $4 \times 53$           | 10. - | 19 $4\frac{1}{2} \times 57$ | 15. 14 | 7 $- \times 82$  |

**Rule 4.** When the multiplier is large, multiply continually by 10, until the value of 100, 1000, &c. according as the question requires, is obtained; next, the value of 1, 10, &c. multiplied by 2, 3, &c. will give the value of as many of any of these as is required. Add these products.

- |       |                               |        |                               |       |                                |
|-------|-------------------------------|--------|-------------------------------|-------|--------------------------------|
| 1. 57 | 18 $9\frac{1}{2} \times 348$  | 5. 77  | 11 $4\frac{1}{2} \times 6352$ | 9. 18 | 11 $11 \times 9145$            |
| 2. 99 | 13 $6 \times 3469$            | 6. 79  | 19 $8 \times 10002$           | 10. 6 | 7 $8 \times 632$               |
| 3. 84 | 13 $9 \times 4660$            | 7. 137 | 18 $4\frac{1}{2} \times 1141$ | 11. 4 | 18 $9\frac{1}{2} \times 561$   |
| 4. 1  | 15 $0\frac{1}{2} \times 7841$ | 8. 15  | 18 $3 \times 673$             | 12. 7 | 11. $11\frac{1}{4} \times 423$ |

## Practical Questions.

What is the price of

- |  |   |
|--|---|
| 1. 14 cwt. sugar, at $21$ $10s$                | 23. 35 score lambs at $8$ $15$ $4\frac{1}{2}$ |
| 7 $\frac{1}{2}d$ per cwt.                      | 24. 52 weeks wages at $14$ $6\frac{1}{2}$     |
| 2. 7 stone wool at $18$ $7\frac{1}{2}$ per st. | 25. 8 yds demity at $9$ $8\frac{1}{2}$        |
| 3. 11 lb. tea at $13s$ $4\frac{1}{2}d$ per lb. | 26. 9 yds cotton at $11$ $5\frac{1}{2}$       |
| 4. 12 yds velv. at $17$ $8\frac{1}{2}p.$ y.    | 27. 42 yds silk at $1$ $16$ $7\frac{1}{2}$    |
| 5. 15 stone sugar at $9$ $10\frac{1}{2}$       | 28. 56 yds lawn $14$ $4\frac{1}{2}$           |
| 6. 18 stone steel at $10$ $11\frac{1}{2}$      | 29. 40 yds cloth at $19$ $4\frac{1}{2}$       |
| 7. 37 oz. silver at $5$ $5\frac{1}{2}$         | 30. 99 yds silk at $5$ $6d$                   |
| 8. 20 cwt. figs $1$ $4$ $8\frac{1}{2}$         | 31. 42 lb. tea at $13$ $4\frac{1}{2}$         |
| 9. 24 fett chin. at $1$ $15$ $4\frac{1}{2}$    | 32. 31 hhds flax at $3$ $4$ $8\frac{1}{2}$    |
| 10. 27 sheep at $2$ $5$ $9\frac{1}{2}$         | 33. 33 pipe wine at $12$ $8$ $6d$             |
| 11. 57 yds silk at $1$ $7$ $8\frac{1}{2}$      | 34. 83 pun. rum at $25$ $12$ $8$              |
| 12. 32 yds velvet at $2$ $8$ $9\frac{1}{2}$    | 35. 97 yds muslin at $4$ $9\frac{1}{2}$       |
| 13. 51 yds ditto at $1$ $15$ $9\frac{1}{2}$    | 36. 21 yds linen at $3$ $7d$                  |
| 14. 35 casks rum at $2$ $17$ $6\frac{1}{2}$    | 37. 77 yds velvet at $12$ $0\frac{1}{2}$      |
| 15. 40 ditto wine at $3$ $12$ $11\frac{1}{2}$  | 38. 73 lb. cloves at $15$ $6\frac{1}{2}$      |
| 16. 76 cwt. raisins at $2$ $18$ $9\frac{1}{2}$ | 39. 99 bar. raisins at $4$ $3$ $7\frac{1}{2}$ |
| 17. 45 cwt. iron at $1$ $4$ $7\frac{1}{2}$     | 40. 75 ditto figs at $1$ $19$ $8\frac{1}{2}$  |
| 18. 60 bales cotton $3$ $14$ $4\frac{1}{2}$    | 41. 336 lb. coffee at $4$ $6d$                |
| 19. 65 ditto ditto at $1$ $17$ $6\frac{1}{2}$  | 42. 87 yds muslin at $4$ $9d$                 |
| 20. 72 bar. tar at $2$ $15$ $4\frac{1}{2}$     | 43. 350 yds ditto at $7$ $0\frac{1}{2}$       |
| 21. 82 bar. do at $1$ $17$ $5\frac{1}{2}$      | 44. 89 lb. snuff at $1$ $6\frac{1}{2}$        |
| 22. 85 stone steel at $4$ $9\frac{1}{2}$       | 45. 450 yds silk at $2$ $3$ $11\frac{1}{2}$   |

46. 95 stone of wool at 14s 7d *per stone* 47. 102 ditto at 33s 11d  
48. 29 score lambs at 4l 5s
49. What is the weight of 47 hhds tobacco, each 6 cwt. 2 qr. 17 lb. 13 drams?
50. — 98 ingots of silver, each 2 lb. 11 oz. 17 dwt?
51. — 45 ditto, each 3 lb. 7 oz. 14 dwt. 13 grs?
52. — 7 parcels of medicine, each 1 lb. 10 oz. 7 dr. 1 scr. 17 grains?
53. — 486 guineas, each 5 dwt. 9 grains?
54. What length of road will a man make in 39 days at 1 pole 5 yds 2 feet 4 inches *per day*?
55. How large is an estate consisting of 9 farms, each 47 ac. 2 roods 13 poles 29 yds?
56. How much flour will a mill grind in 313 days, at 1 qr. 3 bush. 3 pecks *per day*?
57. What quantity of wine will be consumed in a year at 3 ton 3 hhds 57 gal. 5 pints *per day*?
58. What quantity of beer and ale in the same time, at 468 hhds 43 gallons 7 pints *per day*?
59. How far will a man travel in 43 days at 37 miles 5 furlongs 18 poles *per day*?
60. In what time could 9 houses be built, if each, at a medium, require 1 year 11 months 29½ days?

## COMPOUND DIVISION.

*Rule 1.* Begin at the highest denomination. Divide it as in Simple Division. Reduce the remainder into the next inferior name, adding the given number of that name; divide this in the same manner, and so on till the lowest.

*Note, If the divisor is 12, or under, work mentally.*

- |   |                                |                   |
|---|--------------------------------|-------------------|
| 1. 4) 57 18 9                           | 6. 8) 91 13 8                  | 11. 11) 7 10 4    |
| 2. 6) 33 17 6                           | 7. 6) 899 7 6                  | 12. 11) 73 17 8   |
| 3. 5) 798 13 4                          | 8. 7) 6 1 2½                   | 13. 12) 17 1 7    |
| 4. 6) 87 15 6                           | 9. 8) 498 17 8                 | 14. 11) 812 15 0½ |
| 5. 7) 54 15 8                           | 10. 9) 195 15 2½               | 15. 12) 8 19 —    |
| 16. 4) 118 lb. 8 oz. 7 dwt.             | 21. 6) 107 yds 2 foot 6 inches |                   |
| 17. 5) 27 lb. 8 oz. 10 drams            | 22. 3) 53 yds 2 foot 11 inch.  |                   |
| 18. 10) 19 lb 11 oz. 3 dr. 2 scr.       | 23. 5) 87 miles 30 poles       |                   |
| 19. 5) 73 yds 1 qr. 3 na.               | 24. 12) 176 yds 1 quarter      |                   |
| 20. 7) 149 lb. 3 oz. 15 dwt. 22 grains. | 25. 5) 39 hhds 62 gal. 3 pts   |                   |
|   | 26. 2) 64 hhds 61 gal. 7 pts   |                   |

# DIVISION.

23

27. 9)68 cwt. 3 qrs. 22 lb. 30. 12)54 ac. 2 r. 4 poles  
 28. 11)167 lb. 4 oz. 7 dr. 31. 8)302 ton 4 cwt.  
 29. 12)74 lb. 11 oz. 6 dr. 32. 10)158 lb. 3 oz. 14 dr.

1. 17)18 7 6 8. 69)999 18 6 15. 97)918 17 5½  
 2. 23)27 12 - 9. 71)341 16 8½ 16. 98)1118 13 6  
 3. 26)10 8 6½ 10. 74)488 15 8½ 17. 104)332 18 2  
 4. 31)17 1 7½ 11. 78)500 18 1½ 18. 109)102 10 6½  
 5. 43)38 2 4½ 12. 87)931 19 9 19. 231)207 8 4½  
 6. 38)167 7 7 13. 89)478 13 0½ 20. 758)9814 10 5  
 7. 65)418 13 4 14. 79)118 15 7 21. 317)215 12 6½  
 22. 23)490 lb. 3 oz. 5 dwt. 25. 19)142 hhds 29 g. 1 pt.  
                     3 grains 26. 17)249 yds 2 quarters 3  
 23. 57)1025 yds 1 foot 5 in.                      naile  
 24. 61)1062 m. 4 fur. 14 p. 27. 29)168 acres 3 poles

**Rule 2.** When the divisor is the product of any two factors, not exceeding 12; divide successively by these factors.

- 1  
           £. s. d.                      £. s. d.                      £. s. d.  
 1. 24)7 6 0 9. 90)22 6 3 17. 21)37 16 0  
 2. 36)64 19 0 10. 30)37 5 7½ 18. 99)93 16 10½  
 3. 48)37 14 8 11. 45)4 4 4½ 19. 84)75 12 0  
 4. 42)380 9 0 12. 56)22 1 0 20. 120)45 0 0  
 5. 16)78 16 8 13. 50)135 0 0 21. 96)9 2 0  
 6. 55)9134 1 8 14. 36)38 8 0 22. 132)36 6 0  
 7. 63)529 4 0 15. 64)198 8 0 23. 336)81 4 0  
 8. 72)56 14 0 16. 72)113 8 0 24. 112)21 4 8  
 25. 14)104 hhds 61 g. 2 pts 27. 54)971 yds 1 foot 6 in.  
 26. 21)447 lb. 7 oz. 13 dwt, 28. 56)975 m. 3 fur. 24 p.  
                     9 grains 29. 28)162 acres 36 poles

## Practical Questions\*.

1. If 11 yds of cloth cost 4l 5s 0½d, what is the price of 1 yd?
2. A person sold 9 pfs of lawns, each 11 yds, at 38l 5s 2½d, what was the price *per yard*?
3. If 47 lb. tea cost 34l 10s 3½d, what is it *per lb*?
4. If a farm of 57 acres is let at 55l 4s 4½d, what is the rent *per acre*?
5. If 9 hhds sugar weigh 68 cwt. 3 qrs 22 lb. Required the weight *per hhd*?

\* For more, the learner may reverse the practical questions given in multiplication.

6. Three men A, B, C, make an adventure, each equally concerned, whereby they clear 370*l*, what was each man's share of the gain?
7. Seven men are equally concerned in an adventure to Madeira, whereby they lose 878*l* 3*s*, what was the loss of each?
8. Divide 3*l* 10*s* among 5 men and 6 women, and give each man thrice the share of a woman.

*An Exercise upon the preceding Rules.*

1. In 48 purses, each containing a joannes, a moidore, an half-guinea, and half-crown, how many pounds?
2. In 10602 dollars, each 4*s* 3*d*, how many pounds?
3. In 5170 pistols, each 17*s* 6*d*, how many guineas?
4. In 74867 moidores, how many dollars, each 4*s* 6*d*?
5. In 678495 ells Scotch, how many yards?
6. With how many pistols of 18*s* 6*d*, could I pay 2717*l*?
7. How many dollars, each 4*s* 3*d*, are equal to 1312*l* 3*s* 9*d*?
8. In 1939*l* 11*s* 8*d*, how many florins, each 3*s* 2*d*?
9. A gentleman was robbed of the following sums; viz. 54 pieces of 3*l* 12*s* each, 48 of 36*s* each, 234 of 16*s* 6*d* each, 196 of 27*s* each, 215 of 4*s* 9*d* each, 464 notes 50*l* each. Required the amount of his loss?
10. How many lib. of silver in 2 dozen dishes, each dish weighing 25 oz. 15 dwt. and 2 dozen plates, each 15 oz. 15 dwt. 22 grains?
11. How many hhds sugar, each 11½ cwt. in 141680 lb?
12. How many canisters, each holding 12 lb., can I fill out of 25 cwt. 2 qr. 24 lb. of tea?
13. In 1463645160 yds, how many ells Scotch?
14. How many barleycorns will reach round the terrestrial globe, it being 360 degrees, and each degree 69¼ miles?
15. How many ditto will reach round the globe of the moon, its circumference being 6817 miles 2 furlongs 7 poles?
16. In 20790 gallons, how many pipes, puncheons, hhds, and tierces, and of each an equal number?
17. There are 63 stacks of corn, each computed to contain 3 qr. 5 bushels 2 pecks, how much is contained in the whole?
18. The planet Mercury revolves 148 times round the sun in 35 years 249 days. Required the time of one revolution?

19. The distance between London and Edinburgh is 390 miles, how often will a coach-wheel, of 15 feet circumference, revolve in performing the journey?
20. How many letters in a book of 12 volumes, each 421 pages, each page 36 lines, and each line 38 letters?
21. Required the nett weight of 11 hhds, each 6 cwt. 1 qr. 12 lb. tare 1 qr. 14 lb. *per* hhd?
22. Divide 26*l* 3*s* 11½*d* among 4 men, 6 women, and 8 children; and give each man double a woman, and each woman triple a child.
23. Saturn performs his periodic revolution in 10759 days 8 hours, and Mars in 686 days 23 hours 30½ min. how many has each of them performed since the commencement of time and things, reckoning it 5794 years?
24. If 6 chests of Bohea weigh 8 cwt. 1 qr. 18 lb. what is the weight *per* cwt?
25. A gentleman has two dozen table spoons, each 2 oz. 14 dwt. 3 dozen tea ditto, each 14½ dwt. 4 mugs, each 13 oz. 17 dwt. 2 tankards, each 23 oz. 13 dwt. Required the weight of the whole?
26. If 15 hhds sugar weigh 52 cwt. 26 lb. Quere the weight of 1 hhd?
27. What is the nett weight of 7 hhds of sugar, each 3 cwt. 2 qr. 17 lb. tare 18 lb. *per* hhd?
28. — of 56 hhds, each 3 cwt. 24 lb. tare 16 lb. *per* hhd?
29. — of 36 hhds, each 8 cwt. 3 qr. tare 18 lb. 2 oz. 12 drams *per* hhd?
30. — of 5 hhds, each 6 cwt. 2 qr. 14 lb. tare 3 lb. 4 oz. *per* hhd?
31. A merchant paid 89*l* 6*s* 5½*d* for 5 pieces of cloth, each 25 yds; at what must he sell it *per* yard, to gain 1*l* 11*s* 3*d* on the whole?
32. A merchant paid 64*l* 18*s* for 288 yds of cloth, which getting damaged, he is content to lose 1*l* 13*s* by it, at what must he sell it *per* yard to lose so much?
33. A merchant bought 7 pieces of cloth, each 27 yds at 55*s* 12*s*, and sold 56 yds of it at 5*s* 3½*d* *per* yard, and the rest at 6*s* 8*d*; whether did he gain or lose by it, and how much?
34. If a workman gains every week 12*s* 6*d*, and spends 9*s* 11½*d*, how much does he lay up in a year?
35. If a man gains 1*s* 9*d* *per* day, and spends threepence halfpenny, how much does he lay up in a year?

36. If a person's income is  $4s\ 6d$  per day, and expences  $71l\ 1s\ 6d$  per annum, how much does he lay up, or overspend per annum, and how much does he spend per week?
37. If 5 men, equally concerned in an adventure, clear each  $114l\ 18s\ 6d$ , what was gained upon the whole?
38. Four men have an equal share of a voyage to Jamaica, whereby they lose  $348l\ 15s$ ; what was the loss of each?
39. What was the stock of that trading company which consisted of 76 shares, each  $784l\ 13s\ 6d$ ?

## PROPORTION.

PROPORTION is said to be Simple or Compound, according as the proportion depends on one condition only, or on more than one.

### SIMPLE PROPORTION.

In Simple Proportion three numbers, or terms, are given to find a fourth.

Of the three given terms, two are always of the same kind; the other is always of the same kind as the fourth, or term required.

#### Rule 1. To State the Terms.

Place that term which is of the same kind as the term required, in the middle, with two points before and four after it.—Then consider from the sense of the question, whether the answer ought to be *greater* or *less*, than the middle term; if *greater*, put the least of the remaining terms on the left-hand of the middle term, and the greater on its right; but if *less*, the contrary.

#### 2. To reduce the Terms\*.

If the first and third terms are of different names, reduce them into the same, and the middle term into the lowest name in it.

#### 3. To find the fourth Term, or answer.

Multiply the two last terms together, and divide the product

\* If the middle term is of different names, and can be conveniently multiplied by the third—Multiply and divide as directed in Compound Multiplication and Division.



by the first; the quotient is the fourth term, and is always of that name the middle term was reduced into.

If 4 yards of cloth cost 3s, what will 24 yds cost? \*

If 24 yds of cloth cost 18s, what will 4 yds cost?

If I get 4 yds of cloth for 3s, how many will I get for 18s?

If I get 24 yds for 18s, how many will I get for 3s?

§ 1. If 17 yds of cloth cost 4l 5s, what will 307 yards come to?

2. If 7 yds of shalloon cost 10s 6d, what will 99 yds cost?

3. If 100 yds of serge cost 5l 8s 4d, what will 37 yds cost?

4. If 68 yds of cloth cost 17l 19s 10d, what is 7 yds?

5. If 57 yds of linen cost 8l 11s, what will 98 yds 3 quarters cost?

6. If 19 lb. tobacco cost 4l 15s, what will 3 cwt. 17 lb. cost?

7. If 47 yds velvet cost 34l 10s 3¼d, what will 117 yards cost?

8. If 57 yards scarlet cost 55l 4s 4½d, what will four pieces, each 38 yds cost?

9. If 41 hhds of wine cost 287l 2s 6¼d, what will 33 hhds cost?

10. If 51 lb. Bohea cost 19l 12s 0¼d, what will 7 canisters, each 2 cwt. 3 qr. cost?

11. How much tea may be bought for 7l 8s 5¼d, when 14 cwt. 3 qrs costs 872l 16s 3d?

12. How much steel may be bought for 9l 16s 10½d, when 14 lb. cost 10s 11¼d?

13. How many figs for 1l 17s 0¼d at 47l 1s 3d for 1½ ton?

14. What is a man's wages for 73 days at 37l 4s 1d per annum?

15. What is the price of 3 pieces of cloth, each 25 yards, at 4l 19s 11¼d for 17 yards?

16. — of 57 ell Eng. at 1l 9s 2d for 25 yards?

\* The three following questions are deduced from this, and every example admits of being varied in the same manner.

When the terms of a question are so connected, that while one is increased the other increases, or is diminished the other diminishes, the question is said to be direct. But if while the one is increased, the other diminishes, or the contrary, the question is said to be inverse.—The first thirty examples are direct, the next eight inverse; the others are direct and inverse, promiscuously.

17. What is the price of  $7\frac{1}{2}$  ell English, at  $8/12s$  for 14 ell French?
18. — of 12 pieces of cloth, each  $25\frac{1}{2}$  yards at  $20/4s8d$  for 47 ell Flem.
19. — of 6 cheeses, each  $14\frac{1}{2}$  lb. at  $5\frac{1}{2}d$  per lb?
20. — of 56 cwt. 3 qr. 14 lb. of fugar at  $15s4\frac{1}{2}d$  for 18 lb?
21. — of 56 hhds 7 gal. of beer at  $4/6s7d$  per hhd?
22. — of 207 acres 15 po. of land at  $26/17s6d$  per ac.
23. — of 96 bar. 7 pts of ale at  $36s8\frac{1}{2}d$  per barrel?
24. — of 17 gal. of oil at  $37/16s$  per puncheon?
25. — of 7 pieces of silver, each 4 lb. 15 dwt. at 18 guineas for 72 ounces?
26. — of 9 hhds 7 gal. wine at  $4/2s6d$  for 49 gal.
27. — of 7 cwt. 3 qr. 18 lb. of fugar at  $4s4\frac{1}{2}d$  for 11 lb.
28. — of 15 cwt. 27 lb. of tea at  $3/7s4\frac{1}{2}d$  for 7 lb.
29. — of 3 cwt. 16 lb. of iron at  $7s1d$  for 17 lb.
30. — of 56 packs of wool, each 114 stone, at  $13/17s2\frac{1}{4}d$  for 28 stone?
- §31. If 42 men perform a piece of work in 108 days, in what time will 72 do it?
32. If 18 men mow a meadow in 4 days, how many will mow it in 9 days?
33. If 57 masons finish a house in 156 days, in what time will 37 masons do the same?
34. If 28 persons reap a harvest in 36 days, how many persons will reap it in 9 days?
35. If the 9d loaf weigh 4 lb. 6 oz. when wheat is at  $4s$  per bushel, how much should it weigh when wheat is at  $3s9d$ ?
36. If, when wheat is at  $4s6d$ , the 6d loaf weighs 3 lb. what is the price of the same quantity of wheat when it weighs 2 lb. 8 ounce 8 dwt?
37. If a garrison of 2000 men have provisions for 6 months, how many men will the same provisions serve 8 months?
38. If I lend a friend  $275/$  for 9 months, how long must he lend me  $1925/$  to return the favour?
- §39. If 1787 cwt. 2 qr. of lead cost  $907/10s$ , what is that per fodder of  $19\frac{1}{2}$  cwt?
40. What is silver per lb. when 4 lb. 10 oz. costs  $24/17s10d$ ?
41. If a lb. of silver cost  $4/16s6d$ , what is the price of seven pieces, each  $3\frac{1}{2}$  lb.

42. If the sixpence loaf weighs 3 lb. when wheat is at 34s, how much should it weigh when wheat is at 17 5s?
43. If the sixpence loaf weigh 4 lb. 9 oz. when wheat is sold at 17 6s 6d, what is the price of wheat when it weighs 3 lb. 4 ounce 5½ dwt?
44. A bankrupt owes his creditors 4678l, how much will he pay them at 11s 6d per 1l?
45. How many men were in that garrison which consumed as much in 7 months as a garrison of 900 men consumed in one year and nine months?
46. A bankrupt who pays his creditors 13s 4d per pound pays them in all 490l what was his debt?
47. If a garrison of 1000 soldiers have provisions for 9 months, how many must be dismissed that the same provisions may last 15 months?
48. If 37½ yds, yard-wide, be sufficient to hang a room, how many yards 5 quarters wide will do it?
49. What is the tax upon a house, rent 340l, at 3s 6d per £.
50. A bankrupt who owes his creditors 960l, pays them only 504l, how much does he pay them per pound?
51. A garrison has provisions for 10 months at the rate of 16 oz. to each person per day, how much may be allowed per day, that the provisions may last one year?
52. At 15 oz. per day for each man a garrison's provisions will last 8 months, how long will they last if each man is only allowed 12½ ounces?
53. What is the interest of 1750l for a year at 5 per cent. per annum?
54. If my commission is 2½ per cent. what is it for 256l 18s?
55. What is the interest of 650l at 4l per cent. per annum?
56. What is the brokerage of 255l at 4s per cent?
57. What is the factorage of 375l at 2½l per cent?
58. If 425l gained 20l 3s 9d, what was the rate per cent?
59. What principal will gain 64l 5s 6d at 5 per cent. per annum?
60. If 125l in 8 months gain a certain sum of interest, what principal will gain the same in 6 months?
61. If the flooring of a room, 24 feet by 18, cost 17l 2s, what will be the expence of flooring another 30 feet by 22?
62. How much cloth, at 7s 6d per yard, ought to be given in barter for 3 pieces, each 27 yds, at 5s 3d per yard?
63. Bought a quantity of cloth at 19l 12s 0½d, for which I paid at the rate of 7s 8½d, per yard. Required how many yards were in the whole?

64. If the carriage of 169 cwt. 2 qr. for 130 miles cost 734/, what weight may I have carried 78 miles for the same money?
65. Bartered 64 yards of linen at 2s 8d per yard, for 128 yds of cotton. Required the barter price of the latter?
66. If the carriage of 60 cwt. 120 miles be 15s 10d, how far may I have 210 cwt. carried for the same money?
67. A has tea worth 7s 6d ready money, but in barter will have 9s. B has cloth worth 2s 6d ready money; how must B rate his cloth to be even with A?
68. How many yds of cloth at 7s 6d per yard ought to be received for 7 pieces, each 108 yds at 5s per yard?
69. How much cloth, 3 qrs wide, must be given for 90 yds of equal goodness, which is 5 quarters wide?
70. A has cloth at 4s 6d per yd, which he wants to barter with 84 yds at 7s 6d, how many yds must A give?
71. The shadow of a cloud was observed to move 36 yards in 5 seconds, what was the hourly motion of the wind?
72. Bought 6 hhds of wine for 160l 13s, of which I lost 42 gal. required how I must sell a puncheon of the remainder, so as neither to gain nor lose by it?

*Note, If the first term, and either of the other two, be measured by the same number; divide them by it, and use the quotients instead of them.*

73. If 24 yds of cloth cost 36s, what will 141 yds cost?  
 If 8 yards cost 32s, what will 51 yards cost?  
 If 7 lb. cost 25s, what will 49 lb. cost?

### COMPOUND PROPORTION.

In Compound Proportion, five, seven, &c. Terms are given to find a sixth, eighth, &c. proportional term.

One of the terms will always be of the same kind as the term required. And of the others two and two will always be alike, or of the same kind.

#### Rule, 1. *To state the Terms.*

That term, which is like the term sought, must be the middle term. Take of the remaining terms any two which are like. —Place the less first and greater last, or greater first and less last, according as more or less is required, in the same manner as in Simple Proportion.

Proceed thus with every remaining pair of like terms.

## 2. To Reduce the Terms.

Reduce each pair of like terms into the same name, and the middle term into the lowest name in it.

## 3. To find the Required Term.

Multiply the middle term into those terms which stand on its right hand for a dividend, and take the product of those on its left for a divisor, and the quotient will be the answer in the same manner as the middle term.

1. If 100*l* in 12 months gain 5*l* interest, how much interest will 1650*l* gain in three years and 6 months?
2. If 100*l* in 365 days gain 5*l* interest, how much interest will 675*l* gain in 438 days?
3. If 15 men built 37 roods of wall in 27 days, how many roods will 74 men build in 63 days?
4. If 84 men mow 72 acres of grass in 15 days, how many acres will 96 men mow in 12 days?
5. If 600*l* gain 45*l* in 18 months, how much will 100*l* gain in twelve months?
6. What is the interest of 650*l* for 173 days at 5 *per cent. per an.*?
7. ——— of 375*l* for 37 weeks at 5 *per cent. per annum*?
8. If the interest of 175*l* for 39 weeks be 5*l* 18*s* 1½*d*, what is the rate *per cent. per annum*?
9. ——— of 200*l* for 146 days be 2*l* 16*s*, required the rate *per cent. per annum*?
10. What principal will clear 88*l* 2*s* 6*d* in 5 years at 3½ *per cent. per annum*?
11. How long must 975*l* be out at interest to gain 190*l* 2*s* 6*d*, at 4½ *per cent. per annum*?
12. If 236 men eat 160 qrs of wheat in 108 days, how many quarters will 76 men eat in a year and 67 days?
13. If a man can travel 360 miles in 12 days of eight hours each, how many miles will he travel in 60 days of 6 hours each?
14. If 24 men in 36 days, of 12 hours each, can finish a piece of work, in what time will 30 men accomplish it when the days are only 8 hours long?
15. If 30 cwt. be carried 15 miles for 5*l* 8*s* 9*d*, how many miles ought 90 cwt. to be carried for 29*l*?
16. If, when wheat is 10*s* *per* bushel, the 9*d* loaf weigh 3 lb. what is the price *per* bushel, when the penny loaf weighs nine ounces?
17. A solid foot of stone was 16 inches broad and 3 inches thick. Required its length.

18. If 18 men eat 16 shil. worth of bread in 3 days, when wheat is 18s *per* boll, what value of bread will 45 men eat in 27 days, when wheat is 15 shillings *per* boll?
19. Eight men accomplished 30 yds of ditching in 12 days, working 8 hours *per* day, in what time will 12 men finish the said ditch, supposing its whole length 90 yards, when they work only six hours *per* day?
20. If 12 men build a wall 60 feet long 4 thick and 20 in height in 24 days, working 12 hours *per* day, what length of wall 3 feet thick and 12 high, will 18 men build in 18 days, working eight hours *per* day?

## PRACTICE,

Or the method of computation by aliquot parts.

*Table of Aliquot Parts.*

1d = $\frac{1}{12}$ sh.	10 sh. = $\frac{1}{10}l$	2 sh. = $\frac{1}{10}l$	56 lb. = $\frac{1}{2}$ cwt.
$1\frac{1}{2} = \frac{1}{8}$	6s 8d = $\frac{1}{3}$	1s 8d = $\frac{1}{12}l$	28 lb. = $\frac{1}{4}$
2 = $\frac{1}{6}$	5 - = $\frac{1}{4}$	Alfo	16 lb. = $\frac{1}{7}$
3 = $\frac{1}{4}$	4 - = $\frac{1}{3}$	1 far. = $\frac{1}{4}d$	14 lb. = $\frac{1}{8}$
4 = $\frac{1}{3}$	3 4 = $\frac{1}{6}$	1 half. = $\frac{1}{2}$	7 lb. = $\frac{1}{4}$ q. cwt.
6 = $\frac{1}{2}$	2 6 = $\frac{1}{8}$		4 lb. = $\frac{1}{7}$

*Rule, 1.* When the price is an aliquot part of a penny, of a shilling, or of a pound; divide the quantity by that aliquot part; and the quotient will be the answer in that name which the price is an aliquot part of: Which if pence or shillings, reduce to pounds.

- |  |                              |                             |
|--|------------------------------|-----------------------------|
| 1. 74856 lb. yd. &c. at $\frac{1}{4}d$ | 15. 78416 at 2s              | 30. 74964 at 3s 4d          |
| 2. 89945 at $\frac{1}{2}d$             | 16. 74168 at 1s 8d           | 31. 78914 at $\frac{1}{2}d$ |
| 3. 74378 at 1d                         | 17. 37784 at $\frac{1}{4}$   | 32. 74864 at 2s             |
| 4. 74871 at $1\frac{1}{2}d$            | 18. 16874 at 1d              | 33. 87468 at 2d             |
| 5. 87656 at 2d                         | 19. 19648 at $\frac{1}{2}d$  | 34. 74687 at 2s 6d          |
| 6. 785674 at 3d                        | 20. 14638 at 3d              | 35. 7846 at 6s 8d           |
| 7. 48746 at 4d                         | 21. 41974 at 4d              | 36. 91468 at 3s 4d          |
| 8. 87003 at 6d                         | 22. 91687 at 6d              | 37. 74964 at 1s 8d          |
| 9. 49874 at 10s                        | 23. 71348 at $1\frac{1}{2}d$ | 38. 7468 at 4s              |
| 10. 78567 at 6s 8d                     | 24. 14874 at 6s 8d           | 39. 91467 at 10s            |
| 11. 14674 at 5s                        | 25. 14687 at 3s 4d           | 40. 74687 at 2d             |
| 12. 13715 at 4s                        | 26. 19687 at 1s 8d           | 41. 41687 at 3d             |
| 13. 68748 at 3s 4d                     | 27. 4694 at 5s               | 42. 37146 at 4d             |
| 14. 74896 at 2s 6d                     | 28. 78749 at 4s              | 43. 23748 at 6d             |
|  | 29. 56748 at 1s 8d           | 44. 91648 at 4s             |

**Rule 2.** When the price is a simple number but not an aliquot part, multiply the quantity by it; the product will be the answer in the same name as the price. Or divide it into two or more aliquot parts, work for these as in the last rule, and add the results.

*Note, If the price is an even number of shillings, multiply by half their number, and double the first figure of the product for shillings, the rest of this product is pounds.*

1. 48469 at 5d	15. 1468 at 14s	29. 63148 at 11d
2. 74685 at 7d	16. 7849 at 15s	30. 14164 at 7l
3. 96748 at 8d	17. 7464 at 16s	31. 36568 at 6s
4. 49748 at 9d	18. 1485 at 18s	32. 21416 at 7s
5. 41634 at 10d	19. 74684 at 19s	33. 98746 at 9s
6. 7484 at 11d	20. 89 at 36l	34. 34166 at 8s
7. 84678 at 3s	21. 4891 at 7l	35. 94468 at 10d
8. 41687 at 6s	22. 8679 at 11l	36. 91464 at 12s
9. 14896 at 7s	23. 148 at 13l	37. 41448 at 13s
10. 41694 at 8s	24. 1423 at 7d	38. 67841 at 14s
11. 14684 at 9s	25. 41321 at 8l	39. 37482 at 15s
12. 96874 at 11s	26. 48686 at 8d	40. 89164 at 17s
13. 84674 at 12s	27. 98444 at 9d	41. 81638 at 18s
14. 7467 at 13s	28. 71488 at 5d	42. 81964 at 16s

**Rule 3.** When the price is a compound number, and not an aliquot part, multiply by the highest name, and take parts for the inferior ones; the sum of these results is the answer in the same name as the highest: Or, when the price is less than one pound, it may be divided into two or more aliquot parts, as in the last rule.

1. 87495 at $\frac{3}{4}d$	11. 33748 at $4\frac{1}{2}d$	21. 67560 at $7\frac{1}{4}d$
2. 29165 at $1\frac{1}{4}d$	12. 67496 at $4\frac{1}{4}d$	22. 48687 at $8\frac{1}{4}d$
3. 17499 at $1\frac{1}{2}d$	13. 56874 at $5\frac{1}{2}d$	23. 16229 at $8\frac{1}{2}d$
4. 14916 at $2\frac{1}{4}d$	14. 28437 at $5\frac{1}{2}d$	24. 97374 at $8\frac{1}{4}d$
5. 29832 at $2\frac{1}{2}d$	15. 43789 at $5\frac{3}{4}d$	25. 14087 at $9\frac{1}{4}d$
6. 59664 at $2\frac{3}{4}d$	16. 74687 at $6\frac{1}{4}d$	26. 28174 at $9\frac{1}{2}d$
7. 41968 at $3\frac{1}{4}d$	17. 96834 at $6\frac{1}{2}d$	27. 56348 at $9\frac{3}{4}d$
8. 20984 at $3\frac{1}{2}d$	18. 93648 at $6\frac{3}{4}d$	28. 14168 at $10\frac{1}{4}d$
9. 93936 at $3\frac{3}{4}d$	19. 16890 at $7\frac{1}{4}d$	29. 7084 at $10\frac{1}{2}d$
10. 16874 at $4\frac{1}{4}d$	20. 33780 at $7\frac{1}{2}d$	30. 42504 at $10\frac{3}{4}d$

31. 14687 at  $11\frac{1}{2}d$  33. 44061 at  $11\frac{1}{2}d$  35. 4224 at  $12\frac{1}{2}d$   
 32. 29374 at  $11\frac{1}{2}d$  34. 89464 at  $12\frac{1}{2}d$  36. 54824 at  $12\frac{1}{2}d$   
 37. 8460 at  $1s\ 1d$  49. 12049 at  $15s\ 8\frac{1}{2}d$   
 38. 7464 at  $1s\ 2d$  50. 8516 at  $17s\ 3d$   
 39. 47162 at  $5s\ 10\frac{1}{2}d$  51. 6488 at  $18s\ 6\frac{1}{2}d$   
 40. 27518 at  $12s\ 7\frac{1}{2}d$  52. 4678 at  $19s\ 4\frac{1}{2}d$   
 41. 75162 at  $15s\ 4\frac{1}{2}d$  53. 71486 at  $3l\ 6s\ 8d$   
 42. 61474 at  $3s\ 11\frac{1}{2}d$  54. 8948 at  $18l\ 3s\ 4d$   
 43. 30737 at  $4s\ 6\frac{1}{2}d$  55. 48964 at  $18l\ 11s\ 6d$   
 44. 16948 at  $9s\ 8d$  56. 4896 at  $7l\ 8s\ 7d$   
 45. 33896 at  $10s\ 6\frac{1}{2}d$  57. 9164 at  $3l\ 12s\ 10\frac{1}{2}d$   
 46. 8474 at  $11s\ 7\frac{1}{2}d$  58. 79008 at  $3l\ 17s\ 8d$   
 47. 48196 at  $12s\ 8d$  59. 87846 at  $1l\ 11s\ 8d$   
 48. 24098 at  $13s\ 4d$  60. 9878 at  $2l\ 17s\ 4d$

*Rule 4.* When the quantity is a compound number, and the rate of the highest name given, multiply the price by the highest name, and take parts for the others.

*Note,* When the quantity contains a fraction, take proportional parts of the rate for it; or, multiply the rate by the numerator, which product divide by the denominator of the fraction.

- | cwt.qr.lb.    £.s.d.                |   |
|-------------------------------------|---|
| 1. 18 3 4 at 3 18 6 <i>per cwt.</i> | 16. 4 lb. 6 oz. 15 dwt. at 4l 7s 6d <i>per lb.</i>      |
| 2. 20 3 — at 4 17 8                 | 17. 2 1 4 18 at 3 12 6                                  |
| 3. 16 — 22 at 2 13 6                | 18. 18 1 16 5 at 4 4 6                                  |
| 4. 15 3 18 at 4 11 9                | 19. 42 11 — — at — 8 11                                 |
| 5. 6 2 7 at 2 19 3                  | 20. 39 10 13 12 at 5 12 —                               |
| 6. 7 3 18 at — 17 6                 | 21. 86 3 15 — at 4 16 —                                 |
| 7. 72 3 19 at 3 17 4 $\frac{1}{2}$  | 22. 54 7 16 — at 3 12 —                                 |
| 8. 175 3 22 at — 18 8               | 23. 72 11 10 — at 2 4 —                                 |
| 9. 16 2 — at 2 6 11                 | 24. 65 10 14 — at 3 6 8 $\frac{1}{2}$                   |
| 10. 48 2 7 at 74 16 6               | 25. 467 ac. 3 r. 38 pol. at 2l 12s <i>per acre</i>      |
| 11. — — 24 at 4 17 —                | 26. 96 2 24 at 3 18 6                                   |
| 12. — — 17 at 3 5 4                 | 27. 12 3 20 at — 18 11                                  |
| 13. 480 3 14 at 4 6 8               | 28. 15 2 18 at — 19 6                                   |
| 14. 774 2 8 at 3 2 6                | 29. 424 feet 7 in. at 6s 8 $\frac{1}{2}d$ <i>p. ft.</i> |
| 15. 10 — 12 at 1 19 6               | 30. 96 feet 10 in. at 7s 6d                             |



31.  $465\frac{1}{2}$  at  $4s\ 6d$     35.  $687\frac{1}{2}$  at  $4l\ 8s\ 6d$     39.  $964\frac{1}{2}$  at  $15s\ 11d$   
 32.  $167\frac{1}{2}$  at  $5s\ 7d$     36.  $147\frac{1}{2}$  at  $2l\ 14s$     40.  $676\frac{1}{2}$  at  $18s\ 9d$   
 33.  $878\frac{1}{2}$  at  $16s\ 8d$     37.  $146\frac{1}{2}$  at  $17l\ 8s\ 6d$     41.  $686\frac{1}{2}$  at  $18s\ 7d$   
 34.  $868\frac{1}{2}$  at  $15s\ 6d$     38.  $964\frac{1}{2}$  at  $18s\ 6d$     42.  $996\frac{1}{2}$  at  $8l\ 7s\ 6d$

*Promiscuous Exercises.*

1. What costs 7846 yds of shalloon at  $11\frac{1}{2}d$  per yard?
2. — 8974 acres of ground at  $4l\ 6s$  per acre?
3. — 8345 yds of broad cloth at  $19s\ 11d$  per yard?
4. — 6748 yds of demity at  $2s\ 6d$  per yard?
5. — 9674 yds of velvet at  $14s\ 10d$  per yard?
6. — 8341 acres at  $4l\ 12d\ 8\frac{1}{2}d$  per acre?
7. — 6834 hhd of ale at  $3l\ 17s\ 11d$  per hhd?
8. — 648 score of sheep at  $6l\ 11s$  per score?
9. — 674 yards of superfine cloth at  $18s\ 11\frac{1}{2}d$  per yard?
10. — 8341 yards of cotton at  $8\frac{1}{2}d$  per yard?
11. — 6874 sets of buckles at  $15s\ 6d$  per set?
12. — 9146 $\frac{1}{2}$  bolls of wheat at  $15s\ 6\frac{1}{2}d$  per boll?
13. — 3918 yards of brown cloth at  $12s\ 6d$  per yard?
14. — 56 cwt. 18 lb. of tea at  $34l\ 12s$  per cwt?
15. — 37 cwt. 20 lb. 12 oz. of sugar at  $3l\ 8s$  per cwt?
16. — 3 lb. 11 oz. 10 dwt. of silver spoons at  $4l\ 12s\ 6d$  per lb.
17. — 86 lb. 3 oz. 15 dwt. 18 grains of silver-plate at  $4l\ 16s\ 4d$  per lb.
18. — 145 acres 3 r. 15 pol. of pasture at  $18l\ 6s$  per ac.
19. — 95 ac. 2 r. 18 pol. of grass at  $37l\ 15s\ 8d$  per acre?
20. — 4571 $\frac{1}{2}$  yds superfine cloth at  $18s\ 11\frac{1}{2}d$  per yard?

Note, *The gross weight of goods, is the weight of both goods and package. Tare is an allowance made the purchaser for the package. Trett is an allowance of 4 lb. on 104 lb. or  $\frac{1}{16}$  on goods liable to waste. Cloff is an allowance of 2 lb. on 3 cwt. or  $\frac{1}{168}$  for the turn of the scale. The remainder, when farther allowances are to be made, is called futtle; when all allowances are made, it is called nett weight.*

21. What is the nett weight of 468 cwt. 3 qrs. 16 lb. tare 14 lb. per cwt?
22. — of 315 cwt. 2 qr. 21 lb. tare 16 lb. per cwt?
23. — of 896 cwt. 1 qr. 14 lb. tare 8 lb. per cwt?

24. What is the nett weight of 786 cwt. 3 qrs 21 lb. tare 24 lb. *per* cwt?
25. — of 336 cwt. 3 qrs 14 lb. tare 21 lb. *per* cwt?
26. — of 448 cwt. 14 lb. tare 19 lb. *per* cwt?
27. — of 3 casks, each 22 cwt. 2 quarters 15 lb. tare 18 lb. *per* cwt?
28. — of 5 casks, each 73 cwt. 16 lb. tare 25 lb. *per* cwt?
29. — of 12 barrels of figs each 2 cwt. 2 qrs. tare 14 lb. *per* cwt?
30. — of 27 hhds sugar, each 6 cwt. 14 lb. tare 16 lb. *per* cwt?
31. — of 134 cwt. 2 qrs 16 lb. tare 24 lb. *per* cwt?
32. — of 37 bags of coffee, each 4 cwt. 18 lb. tare 13 lb. *per* cwt?
33. What is the trett on 317 cwt. 12 lb.
34. — on 28 cwt. 3 qrs 4 lb.
35. — on 24 bags coffee, each 3 cwt. 16 lb.
36. — on 96 cwt. 3 quarters 14 lb.
37. What is the cloff on 85 cwt. 2 quarters?
38. — on 54 cwt. 2 quarters?
39. — on 39 cwt. 2 quarters?
40. What is the nett weight of 6786 cwt. 2 qrs, tare 18 lb. *per* cwt. deducting also trett and cloff?
41. — of 7 chests of tea, each 16 cwt. 3 qrs. 16 lb. tare 20 lb. *per* cwt. allowing also trett and cloff?
42. — of 5 casks of sugar, each 13 cwt. 24 lb. tare 12 lb. *per* cwt. deducting also trett and cloff?

### *Bills of Parcels, and Bills on Book Debts.*

Mr John Adams

1790.

Bought of James Mercer.

March 8. 8 yards of silk at 13s 8d *per* yard

7 yards of satin at 12s 10d

11 yards of rich brocade at 18s 10½d

12 yards of flowered silk at 15s 11d

9 yards of sarcenet at 4s 3d

16 yards velvet at 25s 10d

£. \_\_\_\_\_

Mr John Wills, Dr.

1790.

		To Henry Hosier.
May 8. To	9 pair worsted stockings at 4s 9d per pair.	
	7 pair thread ditto	3 5
	8 pair silk ditto	13 10
	12 pair cotton ditto	5 8
	18 yards fine flannel	2 3 per yard
	27 ditto ditto	1 9

£.

3. May 4. 1790. Mr John Vyse bought of Jacob Draper 27 yards fine serge at 3s 11d per yard, 17 yds drugget at 7s 10d, 19 yards scarlet at 21s per yard, 13 yds broad cloth at 17s 11d, 29 yards drab at 13s 9d, 19 yards shalloon at 1s 9d.
4. August 10. 1790. Mr Philip Norie bought of Peter Grocer 27½ lb. of green tea at 17s 6d per lb. 17½ imperial ditto at 23s 4d, 44½ lb. bohea at 12s 9d, 18½ ditto at 7s 8d, 37 lb. sugar at 13½d, 11 sugar loaves, each 15½ lb. at 8½d.
5. May 7. 1790. Mr James Scott bought of John Pen 34 reams thick post at 33s per ream, 27 thin ditto at 23s, 16 ditto foolscap 19s, 130 ditto printing demy 15s 6d, 8 ditto superfine royal 43s, 27 ditto cartridge 14s 6d, 7 cwt. pasteboards 17s 6d per cwt.

May 8. 1790. Mr F. Todd, Dr. to Geo. Grant,

6. To 36 yards superfine cloth 22s per yard; 5 pieces satin, each 20 yds at 14s 6d; 7 pieces ditto, each 30 yds at 12s 3d; 5 pieces lustring, each 18 yards at 7s 6d; 28 yds silk at 14s; 3 pieces damask, each 30 yards at 10s 6d; 53 yds silk at 7s 4d.
7. Edinburgh, September 3. 1789. Mr James Freeman bought of Simon Stewart 40 pieces of calicoes, 30 yards each at 2s 4d per yard; 21 pieces, each 27½ yards at 3s 8d; 25 pieces, each 26 yds at 2s 7½d; 16 pieces, each 25 yds at 2s 2½d; 17 pieces, each 29 yards at 2s 3½d; 2 pieces, each 27½ yds at 4s 2d; 53 yds at 7s 6d.
8. 1790. March 11. Mr John Jolly bought of Samuel Draper 34 pieces of osnaburghs, each 37 yds at 8½d per yard;

D

- 49 pieces of Irish linen, each 25 yds at  $1s\ 7\frac{1}{2}d$ ; 33 pieces checks, each  $30\frac{1}{2}$  yds at  $15d$ ; 62 pieces stripped linen, each  $25\frac{1}{2}$  yds at  $4s\ 6\frac{1}{2}d$ ; 20 pieces holland, each 26 yds at  $2s\ 8\frac{1}{2}d$ ; 34 pieces sheeting, each 64 yds at  $1s\ 3\frac{1}{2}d$ ; 27 pieces of flowered cloth, each  $39\frac{1}{2}$  yards at  $3s\ 10\frac{1}{2}d$ .
9. 1789. August 7. Mr Thomas Thomson bought of S. Linnen 57 yards of cambrics at  $5s\ 7\frac{1}{2}d$  per yard, 61 ditto at  $8s\ 5\frac{1}{2}d$ , 79 ells Eng. of lawn at  $8s\ 7\frac{1}{2}d$  per yard, 107 ell Flem. of lace at  $3s\ 8\frac{1}{2}d$  per yd, 95 ells French of lawn at  $15s\ 7d$  per yard, 56 yards linen at  $3s\ 4\frac{1}{2}d$ , 75 yds ditto at  $6s\ 3\frac{1}{2}d$ , 98 yds broad cloth at  $17s\ 8d$ .
10. 1789. April 4. Mr James Retail Dr. to Tho. Manners. To plain linen 550 yds at  $2s\ 8\frac{1}{2}d$  per yard, stripped 654 yards  $2s\ 8\frac{1}{2}d$ , flowered ditto 780 yards  $13s\ 4\frac{1}{2}d$ , sprigged ditto 660 yds  $7s\ 8\frac{1}{2}d$ , cambrics 950 yds  $7s\ 8\frac{1}{2}d$ , stripped ditto 460 yds  $13s\ 4\frac{1}{2}d$ , flowered ditto 468 yds  $7s\ 8\frac{1}{2}d$ , silk gauzes 860 yds  $3s\ 11\frac{1}{2}d$ .
11. Mr Joseph Smith bought of Mr John Last 74 dozen pair mens shoes  $47s\ 3\frac{1}{2}d$  per dozen, 69 ditto  $48s\ 7\frac{1}{2}d$ , 55 ditto pumps  $57s\ 6\frac{1}{2}d$ , 86 pair womens shoes  $45s\ 11\frac{1}{2}d$ , 98 ditto  $48s\ 6\frac{1}{2}d$ , 79 ditto pumps  $49s\ 6\frac{1}{2}d$ , 107 childrens shoes  $35s\ 8\frac{1}{2}d$ , 193 ditto pumps  $39s\ 10\frac{1}{2}d$ .
12. 1790. March 38. Mr Robert Rice bought of Geo. Price 7 hhds sugar, each 9 cwt. 3 qr. 27 lb. at  $27s$  per cwt; raisins 5 bar. each 2 cwt. 1 qr. 8 lb. at  $35s$ ; pepper 7 bags, each  $2\frac{1}{2}$  cwt. 17 lb. at  $7l\ 10s$ ; prunes 5 casks, each 35 cwt. 3 qrs 18 lb. at  $24s$ ; ginger 7 bags, each 4 cwt. 3 qrs 17 lb. at  $35s$ ; currants  $3\frac{1}{2}$  butts, each 17 cwt. 2 qrs at  $47s$ ; 3 hhds tobaccho, each 3 cwt. 18 lb. at  $25l\ 4s$ ; snuff 7 canisters each  $25\frac{1}{2}$  lb. at  $3l\ 14s\ 8d$ ; rice 8 bar. at  $19s$  per bar.; slover-seed 7 bags, each 250 lb. at  $5\frac{1}{2}d$  per lb.
13. 1790. March 19. Mr Richard Robbins bought of James Nivan, 5 casks of tea, each 3 cwt. 1 qr. 18 lb. at  $39l\ 4s$  per cwt; 3 casks of coffee, each 4 cwt. 3 qrs 27 lb. at  $29l\ 8s$ ; 67 cwt. 3 qrs 26 lb. of iron at  $16s\ 8d$ ; 7 hhds sugar, each 8 cwt. 27 lb. at  $3l\ 6s\ 8d$ ; 5 puncheons rum at  $7s\ 9\frac{1}{2}d$  per gal.  $113\frac{1}{2}$  gal. brandy at  $8s\ 2\frac{1}{2}d$ , 117 gal. gin at  $4s\ 9d$ , 57 cwt. 25 lb. raisins at  $6l\ 12s\ 8d$  per cwt, 3 cwt. 17 lb. prunes at  $1s\ 2d$  per lb.  $\pm$  18 lb. figs at  $2l\ 19s\ 8d$  per cwt.

14. 1791. January 8. Mr J. Campbell Dr. to Wil. Currie.

To 13 cwt. 1 qr. 14 lb. ginger at  $4\frac{1}{2}$  13s per cwt. 7 cwt. 2 qrs 27 lb. pymento at 3 $\frac{1}{2}$  18s, 3 hhds logwood, each 4 cwt. 3 qrs 27 lb. at 14s 6d, 115 cwt. 1 qr. 19 lb. allum at 18s 4d, 35 cwt. 27 lb. iron at 17 $\frac{1}{2}$  19s, 375 qrs 5 bush. corn at 33s 8d per qr. 15 lb. 3 oz. 20 grs silver at 5s 2d per oz. 21 bags of wool, each 196 lb. at 1s 3d per lb.; interest of 520 $\frac{1}{2}$  for 15 months at 5 per cent. per annum, 4 hhds linseed at 57s 6d per hoghead.

## VULGAR FRACTIONS.

1. A fraction is a part of an unit, or any thing considered as a whole, and always supposes the unit or whole, divided into some number of equal parts. It is expressed by two numbers, or terms; the one called the Numerator placed above, and the other called the Denominator placed below, a short line thus,  $\frac{3}{4}$  numerator denominator.
2. The denominator shews into how many parts the unit is divided; the numerator expresses the number of these parts which the fraction contains.
3. And, because the whole is always equal to the sum of all its parts, fractions will be less, equal to, or greater than unity, according as the numerator is less, equal to, or greater than the denominator; the first of these is called a proper fraction, the others improper ones.
4. A simple fraction has but one numerator and denominator as  $\frac{1}{2}$ , a compound one is composed of two or more simple ones connected by the word of, as  $\frac{1}{2}$  of  $\frac{3}{4}$ .
5. A mixed number is one partly whole, partly fractional, as  $4\frac{1}{2}$ .
6. If the terms of a fraction are equally multiplied, or divided, its value is not thereby altered.

## REDUCTION.

Prob. 1 $\frac{1}{2}$ , To reduce fractions to their lowest terms; divide both terms by their greatest common measure, which is found thus: Divide the greater term by the less, and the divisor by the remainder continually, till nothing remains. The last divisor is the greatest common measure.

D 2.

Reduce  $\frac{176}{288}, \frac{48}{180}, \frac{7845}{9980}, \frac{8664}{8980}, \frac{740}{8675}, \frac{764}{5240}, \frac{644}{1718}, \frac{768}{1014},$   
 $\frac{3160}{4012}$ , to their lowest terms.

Note, *The common measure may often be found by inspection, thus  $\frac{4}{8}$  is manifestly divisible by 4. Note also, That an even number is divisible by 2; and a number ending with 5 or 0, is divisible by 5.*

Prob. 2d. To reduce mixed numbers to improper fractions; multiply the integer by the denominator adding the numerator, under this sum write the denominator.

Reduce  $4\frac{1}{2}, 6\frac{1}{3}, 14\frac{1}{4}, 15\frac{1}{5}, 12\frac{1}{6}, 7\frac{1}{7}, 11\frac{1}{8}, 13\frac{1}{9}$ , to improper fractions.

Prob. 3. To reduce improper fractions to whole or mixed numbers; divide the numerator by the denominator.

Reduce  $\frac{15}{8}, \frac{19}{7}, \frac{17}{4}, \frac{108}{7}, \frac{101}{8}, \frac{15}{2}, \frac{78}{7}, \frac{66}{7}$ , to mixed numbers.

Prob. 4. To reduce compound fractions to simple ones; multiply all the numerators together for the numerator, and all the denominators together for the denominator of the simple fraction.

Reduce  $\frac{1}{3}$  of  $\frac{4}{11}$ , and  $\frac{1}{7}$  of  $\frac{5}{8}$  of  $\frac{1}{6}$ , and  $\frac{4}{7}$  of  $\frac{5}{12}$  of 6, and  $\frac{1}{3}$  of  $\frac{1}{10}$ , and  $\frac{6}{11}$  of  $\frac{5}{8}$  to simple fractions.

Prob. 5. To reduce fractions to others of equal value, having a common denominator; multiply each numerator into all the denominators, except its own, for a new numerator; and multiply all the denominators together, for the common denominator.

1. Reduce  $\frac{7}{8}$  and  $\frac{5}{6}$  to a common denominator.

2.  $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, 3, \frac{5}{6}, \frac{7}{8}, \frac{8}{9}, \frac{10}{10}, 4, \frac{7}{11}, \frac{8}{9}, \frac{6}{11}, 5, \frac{8}{11}, \frac{12}{11}, \frac{9}{11},$   
 $6, \frac{4}{11}, \frac{11}{11}, \frac{1}{11}, \frac{1}{11}, 7, \frac{4}{11}, \frac{1}{11}, \frac{13}{11}, \frac{16}{11}, 8, \frac{1}{2} \text{ of } \frac{1}{4}, \frac{5}{6} \text{ of } \frac{2}{3},$   
 $\frac{1}{3} \text{ of } \frac{1}{4}.$

Prob. 6. To reduce fractions from one denomination to another; if from a lower to a higher, multiply the denominator by the number of the lower that makes one of the higher: if from a higher to a lower, multiply the numerator thereby.

# REDUCTION.

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- |   |   |
|---|---|
| 1. Reduce $\frac{4}{3}$ of a far. to the fraction of a pound. | 1. Reduce $\frac{1}{1180}$ £. to the fract. of a farth. |
| 2. — $\frac{4}{3}$ sh. — guinea.                              | 2. — $\frac{4}{101}$ guin. — shil.                      |
| 3. — $\frac{2}{11}$ sh. — moidore.                            | 3. — $\frac{1}{11}$ moid. — shil.                       |
| 4. — $\frac{1}{12}$ crown — pound.                            | 4. — $\frac{1}{48}$ pound — crown.                      |
| 5. — $\frac{4}{7}$ far. — shil.                               | 5. — $\frac{1}{84}$ shil. — farthing.                   |
| 6. — $\frac{2}{3}$ h. cr. — pound.                            | 6. — $\frac{1}{12}$ pound — h. cro.                     |
| 7. — $\frac{7}{8}$ penny — guin.                              | 7. — $\frac{1}{88}$ guin. — penny.                      |
| 8. — $\frac{1}{7}$ lb. — ton.                                 | 8. — $\frac{1}{1116}$ ton — lb.                         |
| 9. — $\frac{8}{9}$ oz. — cwt.                                 | 9. — $\frac{1}{1016}$ cwt — ounce.                      |
| 10. — $\frac{4}{7}$ dram — lb.                                | 10. — $\frac{1}{110}$ lb. — dram.                       |
| 11. — $\frac{9}{11}$ yard — mile.                             | 11. — $\frac{9}{10100}$ mile — yd.                      |
| 12. — $\frac{1}{13}$ sec. — hour.                             | 12. — $\frac{1}{1900}$ hour. — sec.                     |

- |   |  |
|---|--|
| 1. Reduce $\frac{4}{3}$ £. to the fraction of a guinea. | 1. Reduce $\frac{1}{11}$ guin. to the fraction of a pound. |
| 2. — $\frac{7}{8}$ crown — moidore.                     | 2. — $\frac{1}{116}$ moid. — crown.                        |
| 3. — $\frac{3}{4}$ pound — joan.                        | 3. — $\frac{1}{12}$ joannes — pound.                       |
| 4. — $\frac{1}{2}$ yd — ell Eng.                        | 4. — $\frac{1}{12}$ ell Eng. — yard.                       |
| 5. — $\frac{1}{3}$ ell Fl. — ell Eng.                   | 5. — $\frac{2}{3}$ ell Eng. — ell Fl.                      |
| 6. — $\frac{4}{9}$ crown — guinea.                      | 6. — $\frac{1}{119}$ guin. — crown.                        |

*Note, In questions such as the following, reduce the given quantity to the lowest name in it for the numerator, and reduce the denomination it is required to be reduced to, into the same name for the denominator.*

- |  |   |
|--|---|
| 1. Reduce 7d to the fract. of a pound.   | 13. Reduce 7 fur. 4 poles to the fract. of a mile |
| 2. — $4\frac{1}{2}$ — shilling.          | 14. — $8\frac{1}{2}d$ — crown                     |
| 3. — $9\frac{1}{2}$ — guinea             | 15. — $6\ 10\frac{1}{2}d$ — half-guin.            |
| 4. — 19 8d — pound                       | 16. — 13 lb. 4 oz. — ton                          |
| 5. — 7 $8\frac{1}{2}d$ — pound           | 17. — 7 dwt 13 qrs — oz.                          |
| 6. — 4 lb. 3 dr. — cwt.                  | 18. — 8 gal. 7 pts — hd be.                       |
| 7. — $7\frac{1}{2}$ dram — lb. av.       | 19. — 17 gallons 5 pints — hhd ale                |
| 8. — 8 dwt $17\frac{1}{2}$ gr. — lb. tr. | 20. — 3 bush. 3 pks — qr                          |
| 9. — 7 gal. $3\frac{1}{2}$ pts hd wi.    | 21. — 5 oz. 7 grs — lb. troy                      |
| 10. — 5 days 3 hours 17 min. — year.     | 22. — 2 r. 17 p. — acre.                          |
| 11. — 5 yds $2\frac{1}{2}$ ft — mil.     | 23. — 24 seconds — hour                           |
| 12. — 3 ro. 5 p. — acre                  | 24. — 15 h. 15 min. — day                         |

## REDUCTION.

**Prob. 7.** To find the value of a fraction; reduce the numerator into the next inferior name; and divide by the denominator. Reduce the remainder into the next lower name; and divide again, and so on, as far as necessary.

What is the value of

- |                                 |                                 |                                   |
|---------------------------------|---------------------------------|-----------------------------------|
| 1. $\frac{7}{140}$ pound?       | 9. $\frac{17}{17}$ hhds wine    | 17. $\frac{88}{480}$ ounce troy?  |
| 2. $\frac{1}{8}$ shilling?      | 10. $\frac{77}{8000}$ year?     | 18. $\frac{71}{412}$ hhd beer?    |
| 3. $\frac{11}{110}$ guinea?     | 11. $\frac{43}{1000}$ mile?     | 19. $\frac{47}{118}$ hhd ale?     |
| 4. $\frac{8}{80}$ pound?        | 12. $\frac{2}{2}$ acre?         | 20. $\frac{1}{4}$ quarter?        |
| 5. $\frac{3}{80}$ pound?        | 13. $\frac{7}{80}$ mile?        | 21. $\frac{2487}{7000}$ lb. troy? |
| 6. $\frac{1027}{28072}$ cwt?    | 14. $\frac{7}{48}$ crown?       | 22. $\frac{9}{800}$ acre?         |
| 7. $\frac{1014}{14400}$ lb. av. | 15. $\frac{1}{84}$ half-guinea? | 23. $\frac{1}{110}$ hour?         |
| 8. $\frac{523}{14400}$ lb tr.   | 16. $\frac{53}{8000}$ ton?      | 24. $\frac{6}{80}$ day?           |

## ADDITION.

**Rule,** Reduce the fractions to a common denominator; add the numerators, and under their sum write the common denominator.

- |   |   |   |
|---|---|---|
| 1. $\frac{7}{8} + \frac{9}{11} + \frac{6}{7}$               | 4. $\frac{3}{7} + \frac{1}{11} + \frac{1}{4}$                     | 7. $\frac{7}{8} + \frac{1}{11} + \frac{1}{11} + \frac{1}{2}$ of $\frac{1}{8}$ |
| 2. $\frac{1}{11} + \frac{6}{11} + \frac{8}{11}$             | 5. $\frac{1}{2}$ of $\frac{7}{8} + \frac{8}{11}$ of $\frac{1}{2}$ | 8. $\frac{7}{4}$ of $\frac{7}{11} + \frac{1}{11} + \frac{1}{11}$              |
| 3. $\frac{1}{11} + \frac{4}{9} + \frac{1}{5} + \frac{6}{9}$ | 6. $\frac{2}{11} + \frac{1}{11} + \frac{1}{11}$                   | 9. $\frac{7}{2}$ of $\frac{1}{11} + \frac{8}{9}$ of $\frac{1}{9}$             |

**Note 1.** When mixed numbers are given, find the sum of the fractions as before; to which add the integers.

10.  $4\frac{1}{2} + 7\frac{1}{2} + 8\frac{1}{2}$     11.  $9\frac{1}{4} + 6 + 8 + 11\frac{1}{4}$     12.  $\frac{7}{8} + 6\frac{1}{11} + 14\frac{1}{3} + 5\frac{1}{4}$

2. When fractions are of different names, reduce them into the same name, by Prob. 6. and add as before; or find their value by Prob. 7. and add as in Compound Addition.

- |  |   |
|--|---|
| 13. $\frac{7}{8}$ sh. + $\frac{4}{11}$ pound                       | 18. $\frac{5}{8}$ yd + $\frac{3}{7}$ ell En. + $\frac{2}{3}$ ell Fl.          |
| 14. $\frac{1}{4}$ sh. + $\frac{5}{8}$ pound + $\frac{6}{7}$ guin.  | 19. $\frac{3}{4}$ d + $\frac{5}{8}$ s + $\frac{1}{4}$ l + $\frac{1}{8}$ moid. |
| 15. $\frac{1}{4}$ lb. + $\frac{1}{7}$ oz. + $\frac{1}{2}$ dwt      | 20. $\frac{1}{3}$ lb. + $\frac{1}{3}$ cwt + $\frac{5}{8}$ ton                 |
| 16. $\frac{3}{8}$ cr. + $\frac{1}{12}$ pound + $\frac{5}{11}$ gui. | 21. $\frac{3}{4}$ qr. + $\frac{1}{3}$ bush. + $\frac{1}{4}$ peck              |
| 17. $\frac{7}{12}$ sh. + $\frac{1}{11}$ d. + $\frac{1}{11}$ joan.  | 22. $\frac{1}{3}$ h. + $\frac{1}{12}$ day + $\frac{1}{4}$ week.               |

23. A borrowed at one time  $84\frac{7}{11}$  l, at another time  $17\frac{5}{7}$  l, at another  $18\frac{5}{8}$  s, at another time  $11\frac{3}{4}$  d; how much did A borrow in all?



## SUBTRACTION.

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24. B went to market and bought of tea  $4\frac{1}{2}$  cwt +  $18\frac{1}{2}$  lb. +  $28\frac{1}{2}$  lb. +  $13\frac{1}{2}$  oz. how much did he buy in all?
25. C went to market and fold of cloth  $54\frac{1}{2}$  yard +  $16\frac{1}{2}$  yard +  $30\frac{1}{2}$  ell Eng. +  $4\frac{1}{2}$  ell Fl. how many yards did he sell in all?

## SUBTRACTION.

*Rule,* Having reduced the fractions, as in Addition, find the difference of the numerators; under which, write the common denominator.

*Note,* In mixed numbers, if the numerator of the fraction in the subtrahend exceed that in the minuend, subtract it from the common denominator; and add one to the units place of the subtrahend.

- |  |                                      |  |
|--|--------------------------------------|--|
| 1. $\frac{4}{7} - \frac{1}{2}$                   | 6. $\frac{9}{11} - \frac{1}{3}$ of 4 | 11. $18 - 5\frac{3}{8}$  |
| 2. $\frac{1}{3} - \frac{1}{6}$                   | 7. $6\frac{1}{8} - 4\frac{1}{2}$     | 12. $13\frac{7}{8} - 4\frac{1}{2}$                                     |
| 3. $\frac{8}{11} - \frac{3}{7}$ of $\frac{1}{2}$ | 8. $7\frac{5}{11} - 3\frac{1}{2}$    | 13. $\frac{1}{11} - \frac{1}{11}$ sh.                                  |
| 4. $\frac{2}{3} - \frac{1}{6}$                   | 9. $8\frac{1}{2} - 4\frac{1}{4}$     | 14. $\frac{1}{3} - \frac{1}{4}$ crown                                  |
| 5. $\frac{1}{4} - \frac{1}{8}$ of $\frac{1}{6}$  | 10. $15 - \frac{1}{7}$               | 15. $\frac{8}{9}$ joannes - $\frac{1}{4}$ guin. + $\frac{1}{2}$ pound. |

16. Paid a debt of  $7\frac{4}{11}$  pound, out of a purse containing  $9\frac{3}{4}$  guineas; how much remained?
17. A's share of a ship was  $\frac{2}{3}$ , of which he sold  $\frac{1}{4}$ ; how much remained?
18. A person who had  $13\frac{5}{8}$  yds of cloth, sold  $7\frac{1}{4}$  yds; how much remained?
19. What part of a ship remained after selling  $\frac{1}{4}$  of  $\frac{1}{8}$  +  $\frac{1}{2}$  of  $\frac{1}{4}$ ?
20. Sold  $\frac{1}{3}$  of  $\frac{1}{6}$  +  $\frac{2}{3}$  of  $\frac{1}{4}$  of a hhd of wine; how much remained?

## MULTIPLICATION.

*Rule,* Multiply all the numerators together for the numerator of the product; and all the denominators together for its denominator.

## MULTIPLICATION.

1.  $\frac{4}{7} \times \frac{11}{12}$

4.  $\frac{7}{11} \times \frac{8}{9}$  of  $\frac{3}{7}$

7.  $8\frac{1}{2} \times \frac{5}{11}$

10.  $5\frac{1}{8} \times 11\frac{1}{2}$

2.  $\frac{4}{11} \times \frac{7}{17}$

5.  $\frac{5}{8}$  of  $\frac{7}{11} \times \frac{9}{11}$

8.  $7 \times \frac{5}{11}$

11.  $18\frac{1}{8} \times 11\frac{1}{2}$

3.  $\frac{11}{17} \times \frac{18}{21}$

6.  $8 \times \frac{5}{7}$

9.  $16 \times \frac{1}{2}$

12.  $3\frac{1}{8} \times 4\frac{5}{8}$

13. What is the value of  $\frac{5}{8}$  yards of cloth at  $\frac{1}{11}$  pound *per* yard?

14. — of  $\frac{1}{7}$  acre at  $2\frac{3}{11}$  pound *per* acre?

15. — of  $17\frac{5}{11}$  yds at  $7\frac{5}{8}$  sh. *per* yard?

16. — of  $3\frac{7}{8}$  ell English at  $5\frac{1}{2}$  *d per* yard?

17. — of  $\frac{1}{4}$  oz. of silver at  $3\frac{1}{8}$  *l per* lb.

18. — of  $60\frac{1}{2}$  gal. wine at  $50\frac{1}{2}$  *l per* ton?

## DIVISION.

*Rule*, Invert the divisor, and proceed as in Multiplication.

1.  $\frac{11}{12} \div \frac{1}{11}$

5.  $\frac{9}{11} \div \frac{11}{908}$

9.  $\frac{3}{4} \div 12$

2.  $\frac{4}{11} \div \frac{16}{111}$

6.  $\frac{5}{7} \div 5\frac{1}{7}$

10.  $11\frac{1}{4} \div 60\frac{1}{2}$

3.  $\frac{18}{11} \div \frac{21}{119}$

7.  $\frac{1}{11} \div 3\frac{1}{8}$

11.  $11\frac{1}{4} \div 213\frac{1}{8}$

4.  $\frac{8}{9}$  of  $\frac{1}{2} \div \frac{5}{108}$

8.  $\frac{5}{11} \div 2\frac{9}{11}$

12.  $4\frac{5}{8} \div 17\frac{1}{8}$

13. If  $7\frac{1}{2}$  yds of lawn cost  $38\frac{7}{8}$ s, what is the price *per* yard?

14. A farm of  $17\frac{3}{11}$  acres was rented at  $14\frac{7}{11}$  *l*, what was the rent *per* acre?

15. What is cloth *per* yard when 7 pieces, each  $11\frac{1}{2}$  yards, cost  $54\frac{1}{8}$  pound?

16. A man performed a piece of work in  $6\frac{1}{11}$  days, what part of the work did he perform in one day?

17. How many stones, each  $13\frac{1}{2}$  inches by  $7\frac{1}{2}$ , will lay a kitchen  $40\frac{7}{8}$  feet long, and  $32\frac{1}{2}$  broad?

18. Divide a ship of  $980\frac{7}{11}$  *l* value into  $21\frac{1}{2}$  shares and a prize of  $1000$  *l* value into  $42\frac{1}{8}$  shares.

## PROPORTION.

*Rule*, State the terms as in integers; and multiply and divide, as directed above.

1. If  $\frac{1}{2}$  yds cost  $\frac{7}{8}$  pound, what cost  $4\frac{1}{2}$  yards?

2. What is the price of  $5\frac{1}{2}$  yds velvet at  $7$ s  $6$ d for  $\frac{1}{2}$  yds?

3. What costs  $\frac{7}{11}$  lb. of tea at  $15$ s  $8\frac{1}{2}$  *d* for  $3\frac{1}{2}$  lbs?

4. What costs 8 cwt 3 qrs at  $14$ s  $8$ d for  $\frac{7}{8}$  cwt?

5. What costs  $15\frac{5}{8}$  yds of silk at  $8s\ 9d$  per yard?
6. What costs  $17\frac{3}{4}$  yards at  $11s\ 8d$  for  $5\frac{1}{2}$  ell English?
7. What costs 3 chests of tea, each 3 cwt 14 lb. at  $5s\ 7d$  for  $1\frac{1}{8}$  lb.?
8. If the value of  $\frac{4}{7}$  ship is  $920l$ , what will  $\frac{1}{7}$  of  $\frac{1}{7}$  come to?
9. The rent of  $\frac{1}{4}$  of a meadow was  $3l\ 12s$ , what will be the rent of  $\frac{8}{9}$  of  $\frac{7}{11}$  at that rate?
10. How many yards of cloth, at  $8s\ 4d$  per yard, must be given for 44 ell English 3 qrs, at  $10s\ 6d$  per ell?
11. The height of my staff, from the ground, is 5 feet 10 inches; and it casts a shadow of 6 feet 5 inches; what is the height of a steeple, which casts a shadow of 220 feet 6 inches?
12. If  $\frac{7}{11}$  of a house cost  $360l$ , what will  $\frac{1}{11}$  of the same come to?
13. A lends B  $454\frac{1}{2}l$  for  $6\frac{1}{2}$  month, how long must B lend A  $204\frac{1}{2}l$  to discharge the obligation?
14. If, when wheat is  $5s$ , the  $2\frac{1}{2}d$  loaf weighs  $8\frac{3}{4}$  oz. what ought the  $6d$  loaf to weigh when wheat is  $8s\ 3d$ ?
15. A can do a piece of work in 18 days, B the same in 20 days, C in 24 days, in what time will they perform it, working together?

*Promiscuous Exercises.*

1. The number 12 may be expressed by a certain digit, repeated four times; so may also the numbers 23, 34, 45, &c. &c. by certain other digits. Quere the digits, and manner of placing them?
2. The number 10 may be expressed by a certain digit repeated thrice; the number 100 by the same digit repeated four times; the number 1000 by the same digit repeated five times, and so on, *ad infinitum*. Quere as before?
3. A jeweller bought 3 pieces of silver— $1l$ , weighing  $3\frac{7}{8}$  lb.  $2d$ .  $11\frac{1}{8}$  ounce.  $3d$ .  $17\frac{3}{8}$  dwt. what did he pay for the whole, at  $5\frac{1}{2}l$  per lb.
4. A shipowner sold  $\frac{1}{4}$  of  $\frac{1}{7}$  of a vessel to one person, and  $\frac{6}{9}$  of  $\frac{5}{9}$ , to another person. Required what part he had remaining?
5. From a cask, containing a puncheon of wine, there was drawn  $\frac{1}{4}$  hhd +  $\frac{1}{7}$  hhd +  $\frac{4}{7}$  runlet; how much remained?

6. What is the difference between  $\frac{1}{2}$  of a bushel, and  $\frac{7}{11}$  of a peck; also between  $\frac{1}{2}$  of a gal. and  $\frac{1}{4}$  of a pint?
7. What is the weight of a box of goods  $4\frac{1}{2}$  feet long  $3\frac{1}{2}$  feet broad  $21\frac{7}{8}$  in. thick, and weighing  $4\frac{1}{4}$  lb. *per solid foot*?
8. What is the price of a piece of wainscot  $7\frac{1}{2}$  feet in length,  $23\frac{1}{2}$  inches in breadth, at  $17\frac{1}{2}$  *d per foot square*?
9. A lady's fortune was  $\frac{4}{5}$  of  $\frac{2}{3}$  of her brother's, which was valued at 3000*l*. Quere the lady's fortune?
10. Divide 876*l* into  $11\frac{1}{2}$  shares.
11. Divide 78*l* among four men and two women, so that the men have equal shares, and the women  $\frac{1}{2}$  of a share each.
12. A person having  $\frac{2}{3}$  of a copper mine, sells  $\frac{1}{3}$  of his share for 396*l*, what was the whole mine worth?
13. What is the price of a silver tea-pot weighing  $1\frac{1}{2}$  lb. at  $\frac{5}{6}$  *l per 1*  $\frac{1}{2}$  ounce?
14. What is the price of  $13\frac{1}{2}$  oz. silver at 5*l* 16*s* for 18*g* lb.
15. If cloth, when  $\frac{3}{4}$  wide, costs 3*g*  $\frac{1}{2}$ *s*, what is the price of the same cloth when  $\frac{5}{8}$  wide?
16. If  $27\frac{1}{2}$  yards of cloth  $\frac{1}{2}$  yard wide cost 10*l* 13*s* 4*d*, what will  $7\frac{1}{2}$  yds cost, when only  $\frac{1}{4}$  yd wide?
17. How many yds of paper  $\frac{1}{4}$  yd broad will line a room 24 feet 8 inches long, 18 feet 11 inches broad, and 11 feet 2 inches high?
18. If 13 yds of cloth,  $\frac{1}{4}$  yd wide, cost 5 guineas; how much cloth of the same goodness, may be bought for 8*l* 12*s*, when  $\frac{3}{4}$  ell Eng. wide?
19. A bankrupt's effects amount to  $\frac{1}{2}$  of his debts, what is that *per pound*?
20. A shepherd being asked the number of his sheep and goats, answered that  $\frac{1}{2} + \frac{1}{4} + \frac{1}{5} + \frac{1}{8} + \frac{1}{10} + \frac{1}{16} + \frac{1}{20}$  of the number of my sheep is to that of my goats as 5 to 1; and  $\frac{1}{2} + \frac{1}{4} + \frac{1}{5} + \frac{1}{8} + \frac{1}{10} + \frac{1}{16}$  of my goats is equal to 110. Required the number of his sheep and goats?
21. A can perform a piece of work in 9 hours, B in  $8\frac{1}{2}$ , and C in  $6\frac{1}{4}$ ; in what time can they perform it all working together?
22. A, B, and C, working together, can finish a piece of work in 8 days; which A can do by himself in 25 days, and B. in 22; in what time could C do it?

## DECIMAL FRACTIONS.

1. Decimal Fractions are such as have for their denominator an unit, with as many cyphers as there are figures in the numerator ; and therefore, having any numerator given, its denominator is thence known ; and so is always omitted ; and the numerators only wrote down, with a point prefixed to distinguish them from integers ; whence they may be worked along with, and in the same manner, generally speaking, as whole numbers \*.
2. The way of reading decimal fractions will be manifest ; for, by the above notation  $\cdot 2 = \frac{2}{10}$ , or two tenths ;  $\cdot 23 = \frac{23}{100}$ , or two tenths three hundredth parts ;  $\cdot 234 = \frac{234}{1000}$ , or two hundred and thirty-four thousandth parts ;  $\cdot 03 = \frac{3}{100}$ , or three hundredth parts ; and so of others.
3. If a vulgar fraction can be reduced to a decimal, without leaving a remainder ; the decimal is called *finite*, or *terminate* ; if not, the decimal is called *infinite*, or *interminate*.
4. Interminate decimals may be distinguished into, 1<sup>st</sup>, Repeating decimals, when the same figure is continually repeated. 2<sup>d</sup>, Circulating decimals, when two or more figures continually repeat. 3<sup>d</sup>, If they repeat, or circulate from the beginning, they are called pure repeaters, or circulates ; if not, they are called mixed ones.

\* Or, decimal fractions may be conceived to arise from the continuation of the common notation scale, beyond unity, towards the right hand ; for then the numbers will decrease in a decimal or tenfold proportion, in the same manner as they increase in that proportion, when continued towards the left hand.

Here we may observe, 1. That the scale, taken in this enlarged point of view, consists of two branches ; the one, containing integers, may be considered as its positive, or increasing branch ; the other, containing decimals as its negative, or decreasing branch. 2. That unity is the common point or term, where the increase and decrease commences ; and that the value of the places depends wholly on their distance from unity. 3. That cyphers, placed on the left hand of decimals, decrease their value ; because they are thereby removed farther from unity ; but that their value is not affected by cyphers placed on the right hand, because their distance from unity is not thereby altered.

## ADDITION AND SUBTRACTION.

*Rule,* Place like names under like names, which is readily done by placing the decimal points under each other; then proceed as in integers.

1.  $478.63 + 89.005 + 5437.25 + .000125 + 91.75 + 541.2375$ .
2.  $6.75 + 89.5 + .00009 + .502 + 7.548$ .
3.  $51.416 + 915.13 + .04751 + .005819 + .000045 + .01018$ .
4.  $74.874 + 81.33486 + .0974 + 1.0718 + 88.71034$ .
5.  $61.371568 + .0091 + .06371 + .0008714 + 43.814$ .
6.  $71.48 - 35.71, 87.31 - 6.871496, 3.187 - 1.00007, .67 - 48 - .377, 1.000009 - .784163, 4.001 - .374, \text{ and } .00078 - .000089$ .

## MULTIPLICATION.

*Rule,* Proceed as in integers; and point off as many decimals in the product, as there are in both factors. If the product has not so many, supply the defect by prefixing cyphers.

- |                          |                        |                       |
|--------------------------|------------------------|-----------------------|
| 1. $74869.3 \times 673$  | 5. $91.07 \times .03$  | 9. $.078 \times .004$ |
| 2. $8914.714 \times 6.7$ | 6. $58.62 \times .3$   | 10. $478 \times .038$ |
| 3. $71.807 \times .0009$ | 7. $74.58 \times .083$ | 11. $748 \times .6$   |
| 4. $.0714 \times .013$   | 8. $.987 \times .642$  | 12. $891 \times .72$  |

*Note,* To multiply by an unit with cyphers, remove the decimal point, at many places, towards the right hand, as there are cyphers.

13.  $78.14 \times 10$ . 14.  $.98516 \times 10000$ . 15.  $6.87146 \times 1000000$ .

## DIVISION.

Proceed as in integers, and point the quotient, so as that there may be as many decimal places in the divisor and quotient together, as in the dividend.

*Note 1.* In case of a remainder, the quotient may be carried to any degree of exactness, by annexing cyphers in terminate decimals; and the repeating, or circulating figures in interminates.

# REDUCTION.

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**Note 2.** *To divide by an unit with cyphers ; remove the decimal point as many places towards the left hand as there are cyphers.*

- |  |                                     |
|--|-------------------------------------|
| 1. $\cdot 11$ ) $1\cdot 4641$              | 7. $\cdot 25$ ) $784689\cdot 5$     |
| 2. $\cdot 8204$ ) $\cdot 504020944$        | 8. $\cdot 75$ ) $87486\cdot 125$    |
| 3. $23\cdot 15$ ) $1836\cdot 88305$        | 9. $\cdot 00785$ ) $\cdot 8741685$  |
| 4. $53\cdot 146$ ) $22118\cdot 6052122$    | 10. $33\cdot 85$ ) $37416\cdot 556$ |
| 5. $\cdot 01548$ ) $\cdot 04888501956$     | 11. $\cdot 785$ ) $18$              |
| 6. $\cdot 8416591$ ) $\cdot 0030266061236$ | 12. $1000$ ) $7486\cdot 35$         |

# REDUCTION.

**Prob. 1.** To reduce a vulgar fraction to a decimal ; divide the numerator, with as many cyphers annexed as necessary, by the denominator.

1. Reduce  $\frac{1}{8}$  to a decimal.

- |                    |                    |                      |                      |                      |                      |
|--------------------|--------------------|----------------------|----------------------|----------------------|----------------------|
| 2. $\frac{1}{4}$ . | 6. $\frac{1}{8}$ . | 10. $\frac{1}{6}$ .  | 14. $\frac{1}{18}$ . | 18. $\frac{1}{12}$ . | 22. $\frac{1}{9}$ .  |
| 3. $\frac{1}{2}$ . | 7. $\frac{1}{3}$ . | 11. $\frac{1}{10}$ . | 15. $\frac{1}{12}$ . | 19. $\frac{1}{7}$ .  | 23. $\frac{1}{14}$ . |
| 4. $\frac{1}{3}$ . | 8. $\frac{1}{9}$ . | 12. $\frac{1}{5}$ .  | 16. $\frac{1}{11}$ . | 20. $\frac{1}{13}$ . | 24. $\frac{1}{15}$ . |
| 5. $\frac{1}{5}$ . | 9. $\frac{1}{6}$ . | 13. $\frac{1}{7}$ .  | 17. $\frac{1}{9}$ .  | 21. $\frac{1}{17}$ . | 25. $\frac{1}{16}$ . |

**Prob. 2.** To reduce a decimal to a vulgar fraction ; the given decimal will be the numerator, and an unit with as many cyphers annexed as there are figures in the decimal will be the denominator of the required fraction, which reduce to its lowest terms.

1. Reduce  $\cdot 5$  to a vulgar fraction.

- |                 |                  |                  |                  |
|-----------------|------------------|------------------|------------------|
| 2. $\cdot 25$ . | 4. $\cdot 125$ . | 6. $\cdot 34$ .  | 8. $\cdot 005$ . |
| 3. $\cdot 75$ . | 5. $\cdot 625$ . | 7. $\cdot 375$ . | 9. $\cdot 078$ . |

**Note,** *If the decimal be a pure repeater, put the repeating figure for the numerator, and 9 for the denominator : If a pure circulate, put the circulating figures for the numerator, and as many 9's for the denominator : If the decimal have cyphers prefixed, annex as many to the 9's in the denominator : If the decimal be mixed, subtract the finite part from the whole decimal ; the remainder is the numerator, (and as*

E

## REDUCTION.

many 9's as there are places in the circle, with as many cyphers annexed as there are figures in the finite part will be the denominator.

1. Reduce  $\cdot 6$ ,  $\cdot 81$ ,  $\cdot 09$ ,  $\cdot 83$ , and  $812$ . to vulgar fractions.

- |                   |                  |                  |
|-------------------|------------------|------------------|
| 2. $\cdot 24$ .   | 6. $\cdot 76$ .  | 10. $\cdot 3$ .  |
| 3. $\cdot 143$ .  | 7. $\cdot 48$ .  | 11. $\cdot 73$ . |
| 4. $\cdot 1524$ . | 8. $\cdot 678$ . | 12. $54632$ .    |
| 5. $\cdot 385$ .  | 9. $\cdot 413$ . |                  |

Prob. 3. To reduce numbers of a lower name to the decimal of a higher; if the given number be simple, divide it by the value of the highest, annexing as many cyphers as necessary; if a compound number, reduce the lowest part to a decimal of the next higher name, prefixing the given part of that name; reduce the number thus obtained to a decimal of the next higher name, and so on, as far as required.

1. Reduce  $9d$  to the decimal of a pound.

2.  $10d$  — pound
3.  $17s\ 6d$  — pound
4.  $12s\ 8\frac{1}{2}d$  — pound
5.  $19s\ 11\frac{1}{2}d$  — pound
6.  $14s\ 3\frac{1}{2}d$  — pound
7.  $3s\ 4d$  — pound
8.  $6s\ 8d$  — pound
9.  $13s\ 4d$  — pound
10.  $11d$  — pound
11.  $4\frac{1}{2}d$  — pound
12.  $\frac{1}{2}d$  — pound

13. Reduce  $7\text{ lb.}$  to the decimal of a cwt

14. —  $8\text{ lb.}$  — cwt
15. —  $17\text{ lb.}$  — ton
16. —  $18\text{ cwt } 13\text{ lb.}$  — ton
17. —  $11\text{ oz. } 17\text{ dwt}$  — lb.
18. —  $13\text{ dwt } 16\text{ grs}$  — lb.

19. Reduce  $5\text{ dwt } 12\text{ grs}$  to the decimal of an oz.

20. —  $7\text{ oz. } 14\text{ drs}$  — cwt
21. —  $10\text{ oz. } 12\text{ drs}$  — lb.
22. —  $3\text{ oz. } 14\text{ dwt } 8\text{ grs}$  — lb.
23. —  $3\text{ quarters}$  — yd
24. —  $1\text{ qr } 2\text{ nail}$  — yard
25. —  $6\text{ fur. } 5\text{ pol.}$  — mile
26. —  $2\text{ ro. } 11\text{ per.}$  — ac.
27. —  $10\text{ in. } 8\text{ parts}$  — foot
28. —  $11d$  — shilling
29. —  $10d$  — shilling.
30. —  $7\frac{1}{2}d$  — shil.
31. —  $12s\ 4\frac{1}{2}d$  — guin.
32. —  $2\text{ hhd } 55\text{ g. wi.}$  — ton
33. —  $5\text{ yd } 2\text{ ft } 11\text{ in.}$  — pol.
34. —  $7\text{ days } 6\text{ h.}$  — year
35. —  $7\text{ h. } 9\text{ min.}$  — day
36. —  $22\text{ minutes } 3\text{ seconds}$  — hour.



## CONTRACTIONS.

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**Prob. 4.** To find the value of a decimal in parts of the integer; multiply it by the number of times the integer contains the next lower name, and point off as many decimals from the product towards the right hand as there are in the given decimal; the figures on the left hand are integers of said lower name; reduce the figures pointed off into the next lower name, and point off as before. Proceed thus as far as necessary.

- |  |                                      |
|--|--------------------------------------|
| 1. What is the value of $\cdot 0375$ ! | 19. What is the value of $\cdot 275$ |
| 2. ——— $\cdot 0416$ !                  | 20. ——— oz. troy                     |
| 3. ——— $\cdot 875$ !                   | 21. ——— $\cdot 004394$ cwt           |
| 4. ——— $\cdot 634375$ !                | 22. ——— $\cdot 671875$ lb. av.       |
| 5. ——— $\cdot 9989583$ !               | 23. ——— $30972$ lb. troy             |
| 6. ——— $\cdot 714583$ !                | 24. ——— $\cdot 75$ yard              |
| 7. ——— $\cdot 16$ !                    | 25. ——— $\cdot 375$ yard             |
| 8. ——— $\cdot 3$ !                     | 26. ——— $\cdot 765625$ mile          |
| 9. ——— $\cdot 6$ !                     | 27. ——— $\cdot 56875$ acre           |
| 10. ——— $\cdot 04583$ !                | 28. ——— $8$ foot                     |
| 11. ——— $\cdot 01875$ !                | 29. ——— $916$ shilling               |
| 12. ——— $\cdot 003125$ !               | 30. ——— $\cdot 83$ shilling          |
| 13. ——— $\cdot 0625$ cwt               | 31. ——— $\cdot 625$ shillings        |
| 14. ——— $\cdot 071428$ cwt             | 32. ——— $\cdot 59027$ guinea         |
| 15. ——— $\cdot 007589$ ton             | 33. ——— $\cdot 718253$ ton           |
| 16. ——— $\cdot 9058$ ton               | 34. ——— $1\cdot 085$ pole            |
| 17. ——— $\cdot 9875$ lb troy           | 35. ——— $\cdot 019863$ year          |
| 18. ——— $\cdot 05694$                  | 36. ——— $\cdot 2979$ day             |
|  | 37. ——— $\cdot 3675$ hour.           |

## CONTRACTIONS.

**I.** To multiply decimals, and retain no more decimals in the product than is thought necessary.

*Rule,* Invert the multiplier, and make the units figure stand under that place of decimals you want to retain in the

product; then begin each line of product by the multiplication of that figure in the multiplicand which stands over the figure you are multiplying by, including the carriage from the right hand place, and write down the products, so that their right hand figures stand under each other.—Extend the product one place farther than is wanted, because of the uncertainty of the last figure.

1. Multiply  $\cdot 874$  by  $\cdot 375$ , and retain 4 decimal places in the product.
2. Multiply  $\cdot 879$  by  $4\cdot 21$ , and retain three places.
3. Multiply  $6\cdot 714$  by  $\cdot 4678$ , and retain 4 decimal places.

II. To contract division; having found the first figure of the product in the common way, for each after figure, divide the last remainder, omitting a figure at each step on the right hand of the divisor, but including the carriage.

- |  |   |
|--|---|
| 1. $\cdot 2465 \overline{) 5789648}$ . | 3. $\cdot 6738 \overline{) 8964896}$ .  |
| 2. $\cdot 4873 \overline{) 9146856}$ . | 4. $\cdot 3785 \overline{) 87468678}$ . |

III. To reduce shillings, pence, and farthings, to decimals of a pound sterling of three places.

*Rule,* Take half the number of shillings for the first decimal place; and the number of the farthings in the remainder increased by 1 if it amounts to 24, or upwards; by 2 if it amounts to 48, or upwards; and by 3 if to 72, or upwards; for the two next places.

- |                        |                         |                            |                              |
|------------------------|-------------------------|----------------------------|------------------------------|
| 1. $8s\ 8\frac{1}{2}d$ | 4. $14s\ 8\frac{1}{2}d$ | 7. $4l\ 10s\ 6d$           | 10. $7l\ 15s\ 8\frac{1}{2}d$ |
| 2. $7s\ 4\frac{1}{2}d$ | 5. $13s\ 5\frac{1}{2}d$ | 8. $3l\ 8s\ 7d$            | 11. $2l\ 13s\ 1\frac{1}{2}d$ |
| 3. $9s\ 6\frac{1}{2}d$ | 6. $17s\ 9\frac{1}{2}d$ | 9. $4l\ 6s\ 8\frac{1}{2}d$ | 12. $3l\ 16s\ 8\frac{1}{2}d$ |

IV. To value decimals of a pound sterling.

*Rule,* Double the first decimal place, and if the second be 5, or upwards, add one thereto for shillings; then divide the second and third places, or their excess above 50 by 4, first deducting 1 if it amount to 25, or upwards. The quotient is pence, and the remainder farthings.

## INTEREST.

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1. .4481	4. .678	7. 4.981	10. .799
2. .3251	5. .904	8. 6.743	11. .867
3. 2.5361	6. .817	9. 4.998	12. .874

The practical questions given under the several rules in vulgar fractions may now be worked decimally.

## INTEREST.

Interest is the allowance given by the borrower to the lender for the use of his money. The amount of any sum is the principal, with the interest added to it.

*Rule,* To compute interest at 5 per cent. for any number of days \*; multiply the principal by the number of days, and divide the product by 7300 †. To compute interest at any other rate; multiply the interest at 5 per cent. found as above, by the given rate, and divide the product by 5.

*Note,* In computing interest for days the 29th of February is not reckoned; nor is the day computed from reckoned, but the day computed to is.

1. Required the interest of 3204/ 14s at 5 per cent. for 37 days.
2. — of 789/ for 36 days, at ditto
3. — of 910/ 15s for 27 days, at ditto
4. — of 874/ for 68 days, at ditto
5. — of 608/ 6s 8d for 58 days, at 4 per cent.
6. — of 780 for 257 days, at 3 per cent.
7. — of 850 for 308 days, at 4½ per cent.
8. — of 260 from May 7. to Sept. 12. at 4 per cent.
9. — of 150/ from Jan. 7. to August 23. at 4½ per cent.
10. — of 630 from Sept. 12. to Jan. 27. at 4½ per cent.

\* This method of computing interest for days is more adapted to practice, than that formerly shewn by Compound Proportion.

† The sum multiplied by the number of days, gives the interest for an equal number of years in shillings; this divided by 365 and 20, or 7300 gives the answer for the number of days in pounds,

11. Required the interest of 720*l* from March 8. to June 7. at 3 *per cent*.  
 12. — of 230*l* from May 27. to September 18. at  $3\frac{1}{2}$  *per cent*.

When several partial payments are made at different times, multiply the principal and several balances into the number of days they are at interest; divide the sum of these products by 7300 for the interest at 5 *per cent*.

13. A bill of 500*l* was due in March 12. of which 150*l* was paid April 7; 200*l* June 28; and the balance Sept. 15. Required how much interest is due?  
 14. Required the interest on a bill of 456*l* due May 7. of which 120*l* was paid June 18. 116*l* Sept. 27. 136*l* Nov. 17; and the balance December 27?  
 15. Required the interest on a bill of 1000*l* due March 13. of which 300*l* was paid April 7; 234*l* May 13; 230*l* July 28; and the balance October 18?  
 16. Required the interest of a bill of 900*l* due Jan. 1, of which 150*l* was paid February 29; 270*l* March 30; 173*l* June 19; 213*l* July 28; 57*l* September 23; and the balance November 17?  
 17. Borrowed March 20, 1789, 1000*l*, of which I paid 300*l* September 17; 150*l* December 21; 220*l* February 23, 1790: I am to pay up the balance July 23. How much will then be due principal and interest?  
 18. Lent January 20, 1788, 2000*l*, of which I received, April 7, 350*l*; September 28, 690*l*; December 18, 420*l*: I am to receive the balance April 7. How much will then be due, principal and interest?

In computing interest on accounts current, add and subtract the sums paid and received, in the order of their dates; and if the balance be sometimes due to the one party, and sometimes to the other; extend the products in different columns.

# INTEREST.

55

19. Required the interest on the following account, at 5 *per cent.*?

Dr. Mr Dinsdale his account cur. with W. F. and Co. Cr.

Jan. 7. To balance	210/	April 14. By cash	130/
Mar. 7. To cash	150	June 27. By cash	215
May 8. To cash	240	Aug. 13. By cash	167
July 21. To cash	300	Oct. 12. By cash	280
Sep. 18. To cash	250	Nov. 18. By cash	120
Dec. 24. To cash	160		

On the following account, at 4 *per cent.*

20. Dr. S. M. and Co. their account current with N M. Cr.

May 1. To balance	250/	June 8. By cash	124/
June 28. To cash	140	July 19. By cash	230
Aug. 11. To cash	340	Oct. 20. By cash	150
Nov. 12. To cash	221	Dec. 12. By cash	200

Required the interest on the following account, at 5 *per cent.*

21. Dr. M. N. his account current with W. H. Cr.

Jan. 1. To cash	120/	Jan. 17. By cash	200/
Mar. 18. To cash	180	July 7. By cash	60
Aug. 24. To cash	320	Sep. 14. By cash	400
Oct. 8. To cash	250		

22. Required the interest on the following account to November 30; allowing 5 *per cent.* when the balance is due to A, B; and 4 *per cent.* when due to R. S.?

Dr. Mr A. B. his account current with R. S. Cr.

Dec. 7. To balance	103/	Mar. 13. By cash	354/
Feb. 13. To cash	118	June 3. By cash	275
Apr. 28. To cash	400	Aug. 17. By cash	100
Sept. 5. To cash	350	Nov. 18. By cash	255

23. On the following account, to Feb. 21. allowing T. M. 5 *per cent.* and G. H. 4 ditto?

Dr. G. H. his account current with T. M. and Co. Cr.

June 8. To balance	107/	Aug. 7. By cash	400/
July 25. To cash	230	Oct. 3. By cash	220
Sep. 7. To cash	321	Dec. 27. By cash	180
Nov. 21. To cash	161		
Dec. 23. To cash	140		

## DISCOUNT.

24. On the following accompt, allowing F. R. 5 *per cent.* and R. C. 4 ditto?

Dr. F. R. his accompt current with R. C. Cr.

March 8.	To balance	80 <i>l</i>	June 18.	By cash	172 <i>l</i>
July 4.	To cash	74	Sep. 23.	_____	98
Oct. 29.	_____	108	Nov. 15.	_____	148
Dec. 17.	_____	217	Feb. 28.	_____	150
Jan. 18.	_____	135			

When partial payments are made, on bonds or bills, at intervals greater than a year; add the interest, at the times of payment, to the principal; and from that amount, deduct the payment.

25. Lent on bond, June 1, 1786, the sum of 750*l*, at 5 *per cent.* of which I received, October 8, 1787, 180*l*; January 1, 1789, 360*l*; the balance is to be paid August 14, 1790. Required how much I have then to receive?
26. Borrowed on bond, March 18, 1785, 600*l*; of which I paid, July 27, 1786, 250*l*; November 17, 1787, 225*l*; February 24, 1788, 175*l*; I paid the balance May 30, 1789. How much did it amount to?
27. Lent to A. B. on bond, Jan. 1. 1787, 1000*l*; of which I received as follows: May 25, 1788, 400*l*; September 3, 1789, 350*l*; the balance is to be paid February 24, 1791. How much will I then receive?

## DISCOUNT.

To find the present worth of any sum due any time hence; or, to find what discount ought to be allowed for receiving present payment of a sum due some time hence.

Rule, *To compute the present worth.*

As the amount of 100*l*, for the given rate and time : to 100*l*. :: so is the debt : to the present worth.

Rule, *To compute the discount.*

As the amount of 100*l* for the given rate and time : to the interest of 100*l* for the same, :: so is the debt : to the discount.

1. What is the present worth of 350*l* due 146 days hence?
2. — of 225*l*, due 60 days hence?
3. — of 212*l* 10*s*, due 73 days hence?
4. Required the discount of 410*l*, due 55 days hence?
5. — of 150*l*, due 80 days hence?
6. — of 220*l* due 125 days hence?
7. What ready money will pay a debt of 1875*l*, due 79 days hence?
8. What ready money will discount a bill of 1000*l*, due in 285 days?

## EQUATION OF PAYMENTS.

To find the time when two or more debts, due at as many different times, may be paid at once.

*Rule*, Multiply each debt by the time which has to run before it be due. The sum of these products, divided by the sum of the debts, will quote the equated time nearly.

1. I owe 60*l* in 40 days, 80*l* in 60 days, and 120*l* in 108 days; when ought the whole to be paid?
2. I owe 74*l* in 50 days, 108*l* in 250 days, and 100*l* in a year; required the equated time for paying the whole?
3. 240*l* is to be paid as follows: 60*l* in 60 days, 80*l* in 96 days, 40*l* in 250 days, and the rest in a year and 35 days; required the equated time for paying the whole together.

COMPOUND INTEREST is computed by making the amount at each term of payment, the principal for the next term.

*Or, by the following*

**RULE**, Find the amount of 1*l* for a year, and raise it to a power; the index of which is the number of years.

Then, 1*l* : this amount :: given principal : its amount.

1. If 400*l* be put out to compound interest for 3 years, at 5 *per cent.* what will the interest and amount be?
2. Required the interest and amount of the same, for the same time at 4 *per cent.*?
3. Required the amount of 200*l* for 4 years, at 5 *per cent. per annum*?

## PARTNERSHIP.

To divide the profits and losses of merchants in company, in proportion to the shares of the capital, or stock; or to divide a number into parts, having the same proportion as certain other numbers.

*Rule,* As the whole stock, : to each particular stock : : So is the whole gain or loss : to the respective shares of it. Or, as the sum of the numbers : to each particular number : : So is the number to be divided : to the required parts.

1. Divide the number 120 into three such parts which shall be as 3, 4, 5.
2. Divide 960 into parts, having the same proportion as 1, 3, 5.
3. Three men, A, B, C, make a joint stock; A's share is 64*l*, B's 88*l*, C's 96*l*; they continue in trade until their profits are 108*l*; required their shares?
4. Four merchants freight a ship to Barbadoes, value of the cargo 1260*l*, whereof A's share is 540*l*, B's 360*l*, C's 240*l*, and D's the rest; they gain 220*l*: required each man's share of it?
5. M, N, and P, make a joint adventure to Jamaica; M's share of the adventure is 230*l*, N's 324*l*, P's 336*l*; they lose 144*l*; required the loss of each?
6. B's share is 940*l*, C's 560*l*, D's 840*l*; they lose 240*l*; required their shares of the loss?
7. A, B, and C, continue in trade for a year, with a stock of 1200*l*; at the end of which A's gain was 40*l*, B's 64*l*, C's 56*l*; required their stocks?
8. A quantity of common, consisting of 240 acres, is to be divided amongst L, M, and N, in proportion to their estates; L's estate is 400*l* a year, M's 350*l*, N's 200*l*; what is each man's share of the common?

*Note,* When the times of their continuing their stock in company are unequal, their respective stocks must be multiplied by their respective times.

9. A's stock of 250*l* was three months in trade, B's of 960*l* was two months, and C's of 540*l* was six months in trade; they gained 480*l*; required their shares?



10. A, B, and C, had a joint stock of 630*l*; A's continued only 3 months, B's 5 months, and C's a year: Also, A's stock was 215*l*, B's 310*l*, and C's the rest; they gained 254*l*; required their shares?
11. A and B enter into partnership for a year, A with 200*l*, B with 160*l*; after four months they admit C with 120*l*, at the end of the year their gain is 150*l*; what is each man's share thereof?
12. A, B, and C, enter into company, A puts in 600*l*, at the end of 8 months he withdraws 200*l*; B puts in 400*l*, and at six months end puts in 200*l* more; C puts in 300*l*, at the end of 4 months puts in 400*l* more; but at the end of 10 months takes out 200*l*; they clear 360*l*; required their shares?
13. Three graziers rent a grass field at 30*l*: A puts in 40 oxen for 4 months, B 60 oxen for 3 months, and C 20 oxen for the rest of the year; what part of the rent ought each to pay?
14. A advances next year 12*l*, and puts in 30 oxen; B pays 10*l* for 40 oxen; and C the rest for 25 oxen: required the time the oxen of each continued at grass?

PROFIT AND LOSS.

- I. Given the prime cost, and the profit, or loss upon it; or, which is the same thing, the difference between it and the selling price, to compute the profit or loss *per cent*.

*Rule*, As the prime cost : to the profit or loss on it : : so is 100 : to profit or loss *per cent*.

1. Bought cloth at 3*s* 8*d*, and sold it at 4*d* *per* yard profit, what was the gain *per cent*?
2. Sold cloth of 15*s* *per* yard value, at 1*s* 6*d* *per* yard loss, what was the loss *per cent*?
3. Bought cloth at 9*s* 6*d* *per* yard, and sold it at 12*s*, what was the gain *per cent*?
4. Bought tea at 5*s* 6*d* *per* lb. but getting damaged, I was obliged to sell it at 4*s* 9*d*, what was the loss *per cent*?
5. Bought 7 cwt 3 qrs of sugar at 5½*d* *per* lb. and sold it at 9*d*, what did I gain *per cent*. and how much upon the whole?
6. How much *per cent*. is 2½*d* *per* shilling?

7. Bought a house for  $315l$ , paid for repairs  $20l$ , and sold it for  $400l$ ; what was the gain *per cent.*?

II. Given the rate *per cent.* and prime cost to find the selling price.

*Rule*, As 100 : to 100 with the rate *per cent.* added to it in case of gain, or deducted in case of loss : : so is the prime cost : to the selling price.

8. Gained  $9\frac{1}{11}$  *per cent.* by cloth which I bought at  $3s\ 8d$ , what did I sell it at?

9. Lost 10 *per cent.* by cloth which I bought at  $15s$ , what did I sell it at?

10. Bought cloth at  $9s\ 6d$ , at what must I sell it to gain  $26\frac{6}{19}$  *per cent.*?

11. I bought tea at  $5s\ 6d$ , but getting damaged am obliged to lose  $13\frac{7}{11}$  *per cent.* by it, what must I sell it at to lose so much?

12. Bought sugar at  $5\frac{1}{2}$  *per lb.* at what must I sell it *per lb.* to gain  $56\frac{2}{3}$  *per cent.* by it?

13. Bought coffee at  $4s$  *per lb.* at what must I sell it *per lb.* to gain  $20\frac{1}{6}$  *per cent.*?

III. Given the rate *per cent.* and selling price, to find the prime cost.

*Rule*, As 100 with the rate *per cent.* added, or deducted : to 100 : : so is the selling price : to the prime cost.

14. If I gain  $9\frac{1}{11}$  *per cent.* on cloth I sold at  $4s$ , what was the prime cost?

15. Lost 10 *per cent.* on cloth which I sold at  $13s\ 6d$ , what was the prime cost?

16. Lost  $13\frac{7}{11}$  *per cent.* by selling tea at  $4s\ 9d$ , what was the prime cost?

17. Gained  $56\frac{2}{3}$  *per cent.* by selling goods at  $9d$ , what was the prime cost?

18. Sold a quantity of cloth at  $4s\ 10d$  *per yard*, by which I cleared  $20\frac{2}{3}$  *per cent.* what did I buy it for?

19. Sold cloth at  $12s$ , on which I gained  $26\frac{6}{19}$  *per cent.* what was the prime cost?

IV. Given two selling prices and the rate *per cent.* in proportion to one of them, to find the rate *per cent.* corresponding to the other.

*Rule,* As the price whose rate *per cent.* is given : to 100, with the given rate added or deducted, :: so is the other given price : to a fourth number, from which subtract 100 in case of gain ; but which subtract from 100 in case of loss. The remainder will be the required rate.

20. By selling cloth at 5s, I gained 12 *per cent.* what did I gain, *per cent.* by selling at 6s?
21. By selling goods at 8s, I lost 14 *per cent.* what did I lose by selling at 7s 6d?
22. Sold goods at 15s 6d, whereby I cleared 18 *per cent.*, but the commodity turning scarce, I sold what remained at 16s 4d; what did I clear, *per cent.* by the latter price?
23. By selling tea at 5s 3d, I gained 16 *per cent.* the same tea was afterwards sold at 4s 6d, what was lost or gained, *per cent.* by the last price?

### PROMISCUOUS EXERCISES.

1. Bought cambric at 4s 3d *per yard*, and sold it at 5s 8d *per ell Eng.* what was gained, or lost in 4 pieces, each 15 yards, and how much *per cent.*?
2. Bought goods at 6s 3d *per quarter*, and sold them at 1l 18s 6d *per cwt*; what was gained in 27 cwt, and how much *per cent.*?
3. Bought cloth at 15s *per yard*, how must it be sold, *per yard*, to gain 3l 6s 8d by 80 yards, and what will be the gain *per cent.*?
4. Bought a cask of rum containing 3 puncheons, at 8s 6d *per gallon*, but having lost 24 gal. by leakage, I want to know at what I must sell the remainder *per gallon*, so as to make up the prime cost of the whole.
5. If 17 cwt 3 qrs of sugar be bought for 49l 14s, and retailed at 9½d *per lb.* what was gained on the whole, and how much *per cent.*?
6. A merchant sold 4 cwt 3 qrs of tea at 136l 8s, whereby he gained 10 *per cent.* what was the prime cost *per lb.*?

7. Bought hops at 5 guineas *per* cwt, how must they be sold *per* lb. to gain 15 *per cent.*?
8. By selling cloth at 17s 6d, I cleared 8 *per cent.* how much did I clear *per cent.* by selling the same cloth at 18s 3d?
9. Bought 69 gallons brandy, and 57 gal. rum, all at 8s 6d; the brandy is sold at 10s 2d; at what must the rum be sold to gain 20 *per cent.* on the whole?
10. If I gain 10d *per cent.* by selling at 2d *per* lb. what do I gain, or lose, *per cent.* by selling at 1½d *per* lb?
11. Sold 33 pipes of wine at 41s 6d, whereby I gained as much as I sold 3 pipes for, what was my gain *per cent.*?
12. A merchant imported 11 pipes of wine, which cost him thirty guineas *per* pipe, and which were bottled into 52 dozen each; bottles, and other charge 2s 4d *per* dozen; he sold one half of it at 16s 2d *per* dozen; the other half he sold at 17s *per* dozen. What did he gain, or lose, upon the whole?
13. A maltster purchases 400 chaldrons of barley at 5l 10s *per* chal. he pays malt-house rent 25l, servants wages 60l, duty 10½d *per* bushel; the malt is sold at 3s 10d *per* bushel, and supposing he had 40 bushel malt for each chaldron of barley, what was the gain, or loss, on the whole, and how much *per cent.*?
14. Shipped on an adventure to Lisbon 300 barrels of salmon at 3l 18s 6d, 450 yards of linen at 2s 7d, 1200 yards broad cloth at 16s, insurance and charges of shipping 44l 8s 6d; the nett proceeds, as *per* account of sales, was 2440l 16s 4d. Required the gain, or loss, and how much *per cent.*?
15. Shipped for Bourdeaux 1200 qrs of wheat at 39s 6d, 600 qrs of barley at 25s 6d, 400 yards of cloth at 15s, insurance on 1800l at 3 guineas *per cent.* policy 10s 6d, commission and other charges 18l 10s; the nett proceeds was 3618l 14s 6d. Required the gain, or loss, and how much *per cent.*?
16. Sold a quantity of cloth at 3s 3d *per* yard, by which I gained 12l, and 8½ *per cent.* required the quantity sold, and the prime cost?
17. Bought quills at 15s, which I sold at 1l 0s 4d, and four months credit, required the gain *per cent.*?
18. Bought paper at 12s, at what must I sell it, and give 6 months credit, to gain 10 *per cent.*?

29. What will I gain, or lose, *per cent.* by selling tea at  $3s\ 4d$  per lb. and eight months credit, for which I paid  $25l$  per cwt. a year ago?

## EXCHANGE OF MONEY.

**EXCHANGE** teaches to find what sum of the money of one country is equal to any given sum of another, according to a given course of exchange. The *par* of the money of one nation compared with that of another, (being always according to their intrinsic value) is fixed. But the *course of exchange*, being the present value allowed for money of one country when reduced to that of another, varies upon different occasions.

In some places money is distinguished into bank and current: The former is more valuable than the latter; and their difference is called *Agio*. Accompts are kept in the latter, and bills of exchange are generally transacted in the former.

The computations may be performed by Proportion, or by Practice.

**I. IRELAND.** Accompts are kept in pounds, shillings, and pence Irish, which are inferior to sterling.

Exchange with Britain is upon the 100 $l$  sterling, which at par is equal to 108 $l$  6s 8d Irish.

1. What sterling is equal to 972 $l$  Irish, exchange 108 $l$ ?
2. What Irish is equal to 385 $l$  sterling, exchange 109?
3. London remits to Dublin 450 $l$  15s sterling, for how much Irish must London be credited, ex. 107?
4. Dublin draws on Britain for 836 $l$  10s, how much sterling will pay the bill, exchange 112?

**II. BRITISH AMERICA.** Accompts are kept in pounds, shillings, and pence currency, whose value is very fluctuating; but is always inferior to sterling.

Exchange with Britain, at so many pounds currency *per* 100 $l$  sterling.

1. How much sterling for 672 $l$  currency, exchange 140 $l$ ?
2. How much Jamaica cur. for 4444 $l$  9s sterling ex. 135?

3. How much sterling in 1413*l* currency of New York, exchange 152*l*?
4. How much currency of Barbadoes in 8246*l* sterling, exchange 140*l*?

III. HOLLAND. Accompts are kept in florins, or guilders, stivers, and pennings.

Exchange with Britain is from 34 to 37*s* gros, or Flemish, *per* pound sterling; *par* is 36*s* 7*d* current; *agio* varies from 2 to 5 *per cent*.

To turn banco into currency, and the contrary, say

100 : 100 + *agio* :: banco : currency.

100 + *agio* : 100 :: currency : banco.

16 pennings = 1 stiver.	2 pence gros = 1 stiver.
20 stivers = 1 guilder.	40 pence gros = 1 guilder.
2 guilders = 1 dollar.	12 pence gros = 1 schilling.
2½ guilders = 1 rix dollar.	20 schil. gros = 1 pound gr.
5½ guilders = 1 ducat.	or Flemish.

1. How many guilders current in 48750 g. banco *agio* 4½?
2. How many guild. banco in 7864 g. cur. *agio* 2½?
3. How much sterling in 7846 guild. banco, ex. 34*s* 6*d*?
4. How many guilders in 4850*l* sterling, ex. 36*s* 6*d*?
5. How much ster. in 854*l* Flemish, ex. 35*s* 6*d*?
6. How many pound Flemish in 648*l* ster. ex. 36*s* 3*d*?
7. How much sterling in 7860 guilders current *agio* 2½; exchange 35*s* 2*d*?
8. How many guild. cur. in 4050*l* ster. ex. 35*s* 6*d* *agio* 3?
9. What is the value of the guild. banco, ex. 36*s* 6*d*?
10. What is the value of the guilder current, ex. 36*s* 7*d* *agio* 4?
11. In 6789*l* 15*s* sterling, how many pounds Flemish, exchange 35*s* 6*d*?
12. In 7968*l* 10*s* Flemish, how much ster. ex. 34*s* 8*d*?
13. Britain draws on Amsterdam for 895*l* 15*s* sterling, how much Flemish will pay the draught, ex. 35*s* 6*d*?
14. Britain remits Amsterdam 4896 guild. 15 stivers, how much sterling will pay the bill, ex. 35*s* 4*d*?

IV. GERMANY, *Hamburg*. Accompts are kept in marcs, and shilling-lubs. The *agio* varies from 15 to 25 *per cent*.

Exchange with Britain is by so many shillings and pence gros,  
per pound sterling.

Exchange with Holland about 33 stivers banco per dollar of  
Hamburgh.

12 phennings = 1 schil. lubs	6 phenn. = 1 pen. gros
16 schil. lubs = 1 marc lubs	2 pen gr. = 1 schil. lubs
2 marcs = 1 dollar	6 sch. lubs = 1 schil. gros
3 marcs = 1 rix dollar	32 pen. gr. = 1 marc lubs
6½ marcs = 1 ducat	120 sch. lubs, or 7½ marcs = 1 gros.

1. How much ster. in 269600 marc lubs banco, ex. 33s 4d?
2. How many ml. in 9648/ ster. ex. 33s 10d?
3. How many ml. in 8468 guild. ex. 33½?
4. How many guild. in 4968 ml. ex. 32½?
5. How much ster. in 13284 ml. cur. agio 20, ex. 33s 10d?
6. How many ml. current in 482/ ex. 33s 4d, agio 15?
7. How many ml. current in 4892 guild. current, agio in Holland 3, ex. 32½, agio in Hamburgh 18½?
8. How many current guild. in 4500 ml. current, agio in Hamburgh 25, ex. 32, agio in Hol. 4?
9. How many ml. cur. in 21528 g. cur. agio in Hol. 3½, ex. 32½, agio in Hamburgh 18½?

V. FRANCE. Accompts are kept in-livres, sols, and deniers.

12 deniers = 1 sol	3 livres = 1 ecu or crown
20 sols = 1 livre	24 livres = 1 louis d'or.

Exchange with Britain at from 28 to 34d per crown, par 29½.

———— Holland about 28 stivers banco per crown.

———— Hamburgh about 26 sh. lubs per crown.

1. How much sterling in 480 livres, ex. 30½?
2. How many livres in 96/ sterling, ex. 32?
3. How many guild. in 480 livres, ex. 28½?
4. How many livres in 4680 guild. ex. 27½?
5. How many cur. guild in 8964 livres, ex. 27½, agio 3½?
6. In 76844 g. current, how much French, agio 3, ex. 28½?
7. How many livres in 56160 m. l. agio 20, ex. 26½?

VI. PORTUGAL. Accompts are kept in milrees and rees.

1000 rees = 1 milree	400 rees = 1 crusado.
4800 rees = 1 moidore	6400 rees = 1 joannes.

Exchange with Britain 65 to 70*d* per milree, par 67½*d*.

————— Holland about 50*d* gros*s* per crusado.

————— France about 430 rees per crown.

1. In 421*l* 17*s* 6*d*, how many milrees, ex. 67½*d*?
2. In 1420 milrees, how many liv. exchange 432?
3. In 8460 milrees, how many guilders, ex. 48, agio 3?
4. What is the value of the moidore and joan, ex. 67½?
5. In 480 milrees, how much sterling, ex. 68?
6. In 8718 livres, how many milrees, ex. 430?

VII. SPAIN. Their money is distinguished into vellon, and old plate; the former is to the latter as 32 to 17. Shopkeepers reckon by vellon; and bills of exchange are transacted in plate. Accompts are kept in rials and marvadies.

34 marvadies = 1 rial	4 piastra = 1 pistole of ex.
8 rial plate = 1 piastra	5 piastra = 1 pistole
10 rial plate = 1 dollar	375 mar. = 1 ducat.

Exchange with Britain 40 to 45*d* per piastra, par 43*d*.

————— Holland about 110*d* gros*s* per ducat.

————— France about 18 livres per pistole.

————— Portugal about 630 rees per piastra.

1. How much sterling in 1500 rial plate, ex. 42*d*?
2. How many current guild. in 9000 rials plate, exchange 112, agio 3?
3. In 12375 rial pl. how many milrees, ex. 640?
4. In 85*l* 16*s* 2*d*, how many rials vellon, ex. 41?
5. In 956 guild. 17 stivers, how many rials plate, exchange 108, agio 3?
6. In 4317 livres 13 sols 8 den. how many rials plate, exchange 17½?

VIII. ITALY. Money is distinguished into banco and current; the former having a constant superiority of 20 per cent.; and also a variable agio.

Their money is likewise distinguished into lire and exchange money. Accompts are kept in the former, and exchange transacted by the latter.



12 picoli = 1 foldo.

20 soldi = 1 lire.

Venice exchanges by the ducat banco.

Genoa ————— by the pezzo of  $5\frac{1}{2}$  lires.

Leghorn ————— by the piaſtre of 6 lires.

Florence ————— by the ducat of  $7\frac{1}{2}$  lires.

The ducat, pezzo, piaſtre, &c. are each divided into 20 ſoldi;  
and theſe into 12 denari; in the ſame manner as the lire  
money, or our pound ſterling.

*Pope's Territories.* Accompts are kept in crowns and julios  
—Exchange by the ſtamped crown. 10 julios = 1 cur-  
rent crown; 12 julios = 1 ſtamped crown.

*Naples.* Accompts are kept in ducats, tarins, and grains.

20 grains = 1 tarin, 5 tarins = 1 ducat.

Exchange by the ducat = 3s 4d.

1. How much ſterling in 7860 ducats banco of Venice, ex-  
change 52d?
2. How many ducats in 2014l 10s, ex. 51d per ducat?
3. How much ſterling in 448 ducats 16 ſol, ex. 51½d?
4. In 96l 6s 1½d, how many ducats, ex. 51½d?
5. In 47868 pezzo of Genoa, how much ſterling, ex. 51½d?
6. In 10321l 10s 9d ſterling, how many pezzos, ex. 51½d?
7. How many lires of Leghorn in 665l 2s 6d, ex. 51d?
8. How many lires of Florence in 132l 10s 6d, ex. 62d?
9. How much ſterling in 1404 current crowns of Rome, ex-  
change 71d?
10. How much ſterling in 1102 ducats of Naples, ex. 3s 4d?
11. What French money is equal to 4878 lires of Genoa, ex-  
change 108 ſols per pezzo?
12. How much money of Spain in 5512 lires 10 ſol of Flo-  
rence, exchange 380 marvadies per ducat?
13. How much money of Holland in 1890 ducats of Venice,  
exchange 92d per ducat?
14. How much Hamburgh money current in 3720 lires cur-  
rent of Venice, agio 25, ex. 91d, agio 15?
15. How many ducats banco of Venice in 8664 current crowns  
of Rome, ex. 66 ſtamped crowns per 100 ducats?
16. How much money of Florence in 1890 rials plate of Spain,  
ex. 428 marv. per ducat?

IX. DENMARK and NORWAY. Accompts are kept in rix dollars Danish, marcs, and skillings.

16 skillings = 1 marc.

4 marcs = 1 ort.

6 marcs = 1 rix dollar.

11 marcs = 1 ducat.

Exchange with Britain from 4 to 5 rix dollars *per* pound, *par* 4s 6d.

Exchange with Holland about 110 rix dollars Danish *per* 100 rix dol. banco.

————— Hamburg about 250 marc-lub banco *per* 100 rix dollars Danish.

1. In 6780l sterling; how many rix dol. exchange  $4\frac{1}{2}$ ?
2. In 8964 rix dol. 2 mar. 8 sk. how much ster. ex.  $4\frac{1}{2}$ ?
3. In 254176 guild. current; how many rix dol. agio 4; exchange 108 $\frac{1}{2}$ ?
4. In 8284 rix dol. how many current guild. exchange 109, agio 3?
5. How many R. in 6254 m. l. cur. agio 18, ex. 254?
6. In 6780 R. how many m. l. ex. 255, agio 18?

X. SWEDEN. Accompts are kept in copper dollars, marcs, and ures.

8 ures = 1 copper marc

3 cop. dol. = 1 silver dollar

4 cop. m. = 1 cop. dollar

2 sil. dollar = 1 rix dollar.

To reduce copper dollars to silver marcs; multiply by 4, and divide by 3.

Exchange with Britain at so many copper dollars *per* pound sterling.

————— Holland and Hamburg at so many silver marcs *per* rix dollar.

1. In 47790 cop. dol. how much sterling, ex.  $40\frac{1}{2}$ ?
2. In 1407l, how many copper dol. ex.  $39\frac{1}{2}$ ?
3. How many guild. in 52269 copper dol. ex.  $12\frac{1}{2}$ ?
4. How much Swedish money in 1000 guild. ex. 14?
5. How much Hamburg money in 7857 cop. dol. ex. 12?
6. How many cop. dol. in 10476 marc lub, ex. 14?

**XI. POLAND and PRUSSIA** accompts are kept in Polish florins, and grofs.

30 grofs = 1 florin.

3 florins = 1 rix dollar.

Exchange with Britain at so many pence *per* florin, par 1s 2d.

————— Holland at so many grofs *per* pound Flemish banco.

————— Hamburg at so many grofs *per* rix dol. banco.

1. How much Polish in 576l, ex. 13½d?
2. In 7854 florins 15 grofs, how much sterling ex. 13½?
3. How much polish in 2780 guild. ex. 305?
4. How much polish in 2180 marc lubs, ex. 120?
5. How much in 89615 guild. 15 stivers current, agio 2½, exchange 315?
6. How much in 1637 m. l. 4 s. l. current agio 18, ex. 312?
7. In 7650 florins, how many current guilders, exchange 306, agio 5?

**XII. RUSSIA.** Accompts are kept in roubles and copecs.

100 copecs = 1 rouble.

Exchange with Britain at so many pence *per* rouble.

————— Holland about 50 stiv. *per* rouble.

————— Hamburg about 110 copecs *per* R. lubs.

1. What sterling is equal to 1785 roubles, ex. 4s 5d?
2. What Hamburg money is equal to the same, ex. 105?
3. What is the value of 1636 roubles drawn in London, exchange 4s 5½d?
4. What is the value of 6436 roubles drawn on Holland, exchange 48; and from Holland on London, ex. 34s 6d?
5. What is the value of 2160 roubles drawn on Hamburg, ex. 108; and from Hamburg on London, ex. 33s 3d?
6. What is the value of 1728 roubles drawn on Holland. exchange 50, commission there ½ *per cent.*; and from Holland on London, ex. 35s 4d?
7. What is the value of the same drawn on Hamburg, ex. 110, commission ½ *per cent.*; and from Hamburg on London, exchange 33s 6d?

### *Drawing and Remitting of Money.*

As the course of exchange is variable, drawing and remitting may be attended with either loss or advantage. It being manifest, from a little consideration, that the less value the money of a merchant's own country bears abroad, the more he will gain by drawing, and lose by remitting; and the greater its value, the contrary. Whence, *when the exchange is made upon British money, as the pound sterling, &c.* Britain will gain by remitting when the course is high, and lose by drawing; but when the course is low Britain will gain by drawing, and lose by remitting. But if *the exchange is transacted by the Foreign piece, as the French crown, &c.* the contrary. Therefore, *To gain*, when the exchange is by *British money*, remit when the course is high, and draw when it is low—When upon the *Foreign piece*, draw when the course is high, and remit when it is low.

*To compute the gain or loss.*

**Rule,** When upon the Foreign piece, the sum drawn is to the sum remitted, as the course of exchange *directly*.—When upon British money, the sum drawn is to the sum remitted as the course of exchange *inversely*.

1. What is gained or lost by remitting 1200*l* sterling to Paris when the exchange is 30*d*, and drawing when the exchange is 32*d*?
2. Edinburgh owes Ireland 480*l* sterling when the exchange is 6 *per cent.*; what sum should be remitted should the exchange rise to 10 *per cent.*?
3. When the exchange with Ireland was at 9 *per cent.* a merchant in Edinburgh drew for 960*l* ster.; what did he gain or lose by remitting when the ex. was at 6½ *per cent.*?
4. London drew on Hamburgh for 1000*l*, ex. 36*s* 4*d*; what was gained, or lost, by replacing the draught when the exchange fell to 33*s* 6*d*?
5. Britain drew on Amsterdamb for 6000*l*, ex. 36*s* 8*d*, but was obliged to replace the draught when the ex. was at 33*s* 10*d*; what was lost, or gained, on the whole, and how much *per cent.*?

6. Britain owes Jamaica 780*l* 15*s* ster. exchange 108 *per cent.*; how much sterling will pay the draught when the exchange is 105 *per cent.*?
7. London remitted Hamburg 4000*l*, ex. 36*s* 6*d*, and drew for the value ex. 34*s* 2*d*; what was gained, or lost, and how much *per cent.*?
8. What is gained, or lost, by remitting 750*l* sterling to Spain, ex. 40*d*, and drawing for the value ex. 45*d*, and how much *per cent.*?

### *Arbitration of Exchange.*

Having the rates of exchange between two or more places given, to find the rate of exchange between the first and last, in correspondence to the rest.

*Rule,* Place the given equations under each other, so that terms of the same kind stand always on different sides. Then take the product of the terms on that side of the equation, having the odd term for a dividend, and the product of those on the other side for a divisor: The quotient is the required quantity.

Or we may work after the manner of Proportion, by placing the odd term in the middle; and considering each equation as a pair of like terms.

1. If 6 yards of Hamburg are equal to 5 in Holland, and 7 in Holland = 4 in France, and 5 in France = 5 in England; how many yds English will = 1176 yds of Hamburg; and how many yds of Hamb. will = 100 yds English?
2. If the rate of exchange between London and Holland be 34*s* 8*d*, and between Holland and Hamburg 34 stivers; what is the arbitrated rate of exchange between London and Hamburg?
3. If London exchange with Hamburg at 34*s* 6*d*, and Hamburg with Holland 33 stivers; what is the rate of exchange between London and Holland by arbitration.
4. If London ex. with Holland at 35*s* 6*d*, and Holland with Hamburg at 32½ stiv. and Hamburg with France at 26 *l*. 1*s*; what is the arbitrated rate of exchange between London and France?
5. Amsterdam changes on London at 34*s* 2*d*, and on Lisbon at 50*d* for 400 rees; how ought the exchange to go between London and Lisbon?

6. Paris remits to Amsterdam 9100 crowns by way of London at 30*d*, thence to Rome at 65*d* *per* stamped crown, thence to Venice at 100 stamped crowns *per* 140 ducats, thence to Leghorn at 100 ducats *per* 100 pias. and thence to Amsterdam at 88*d* *per* pias; how many guilders will be received at Amsterdam; and how many crowns will be remitted to Paris, exchange 54*d*?

*Promiscuous Exercises.*

1. Leith draws on Jamaica for 1127*l* 10*s* sterling; how much currency will pay the draught, ex. 60 *per cent*?
2. Edinburgh owes Leghorn for a cargo, *per* the Caledonia, liras 3708; what sterling does it amount to, exchange 4*s* 3*d* *per* piastre?
3. London owes Lisbon for a cargo of wine, *per* the Hopeful, 9210 milrees; how much sterling must London remit Lisbon, exchange 5*s* 6*d*?
4. Amsterdam remits to London 19315 guild. current 9 $\frac{7}{10}$  fliv. ago 2, ex. 35*s* 6*d*; for what will Amsterdam be credited in London?
5. London received 1500*l* for 14832 guild. due in Holland, agio 3; what was the rate of exchange?
6. Paris draws on London for 1860 livres ex. 32; what ster. will clear the draught?
7. Hamburg owes London for a cargo, *per* the Hazard, 18975 m. l. current, agio 15 *per cent*.; how much sterling must London draw for, exchange 33*s* 4*d*?
8. In 4816 m. l. current, agio 24; how many guild. current, exchange 33, agio 5?
9. What sterling will equal R. 7909 $\frac{1}{2}$  Danish, drawn on Amsterdam, ex. 112, commission there  $\frac{1}{4}$  *per cent*.; and drawn from Amsterdam on London, ex. 35*s* 2*d*?
10. How many R. will equal 1082*l* 5*s* 4*d* sterling drawn on Hamburg, ex. 33*s* 1*d*, com. there  $\frac{1}{4}$  *per cent*.; and drawn from Hamburg on Denmark, ex. 254?
11. Hamburg owes E. of Edinburgh, for nett proceeds of a cargo, 1000 m. l.; he may order it to be remitted directly, ex. 1*s* 6*d* *per* m. l. or by Holland, ex. 32 $\frac{1}{2}$ , and from Holland on London, exchange 35*s* 10*d*; required the cheapest way?
12. New England consigns to Leghorn 1500 quintals of fish with orders to remit to London, the cargo is sold at 14

- plaf. 18 sol. *per quintal*; what sterling will the factor remit, retaining 3 *per cent.* com. ex.  $53\frac{1}{2}d$  *per* plaf.
13. London draws for 45000*l* on Dublin at par, and remits the same, ex.  $110\frac{1}{2}$  *per cent.* required the gain, or loss?
14. A wood merchant in Leith imported, from Russia, wood to the amount of 8760 roubles, he may order it to be drawn directly, ex.  $4s\ 8d$ ; or on Holland, ex.  $48\frac{1}{2}$ , and from Holland on London, ex.  $35s\ 10d$ ; or on Hamburg, ex. 106, and from Hamburg on London, ex.  $33s\ 6d$ . Required the cheapest medium?
15. Edinburgh owes Paris 1500 livres, how much sterling must be remitted to Amsterdam to clear the draught, exchange between Paris and Amsterdam  $27\frac{1}{2}$ , and between Amsterdam and London  $36s\ 8d$ ?
16. Leith owes in Denmark 8400 R. ex.  $4\frac{1}{2}$ ; whether is it cheapest to remit it directly; or by Holland, exchange between Denmark and Holland  $108\frac{1}{2}$ , and between Holland and London  $35s\ 11d$ , com. in Holland  $\frac{1}{2}$  *per cent.*?
17. Britain laid out, in purchasing bills on Ireland, 4000*l*, ex. 12 *per cent.* the exchange fell to 8 *per cent.* what sum will Britain then draw for?
18. A. of Paris draws on B. of London for 4104 crowns, exchange 52*d*, B. draws on A. for the value, ex. 54*d*, retaining  $\frac{1}{2}$  *per cent.* commission; what did A. gain, or lose, by this transaction?
19. A. of Edinburgh draws on B. of Amsterdam for 7896 guild. at  $22\frac{1}{2}d$  *per* guild. cur. B. draws on C. of London for the value, commission  $\frac{1}{2}$  *per cent.* ex.  $35s\ 10d$ , agio 2 *per cent.*; A. remits a bill for the value, allowing  $\frac{1}{2}$  *per cent.* com. for which he pays  $\frac{1}{2}$  *per cent.* exchange. Required the gain, or loss?
20. A merchant in Edinburgh owes 1728 m. l. in Hamburg, he may order it to be drawn on London, exchange  $33s\ 4d$ , agio 18; or on Holland, ex.  $33\frac{1}{2}$ , commission there  $\frac{1}{2}$  *per cent.* ex. from Holland on London  $35\frac{1}{2}$ ; required the cheapest way?
21. V. of Vienna owes to London 4800 rix dollars, he may remit it directly at  $3s\ 6d$  *per* rix dollar; or through Holland ex.  $136\frac{1}{4}$  *per cent.* com. there  $\frac{1}{2}$  *per cent.* and ex. to London 35*s*; or through Hamburg, ex. 136 *per cent.*, com.  $\frac{1}{2}$  *per cent.* and ex. to London 34*s*; required the cheapest medium?

- 22., Required the value of 8960 Polish florins drawn on Holland, exchange 316, and from Holland on London, ex. 35s 6d; of the same drawn on Hamburg, ex. 124, and from Hamburg on London, ex. 35.
23. E. of Edinburgh drew on H. of Holland 4800 g. exch. 35s 6d at three months date, at the end of which, H. redrew on E. for the value, retaining  $\frac{1}{2}$  per cent. com. at 1 month's date, ex. 35s 4d; required E's loss, or gain, allowing interest at 5 per cent.
24. Consigned to my Factor at Oporto 86 pieces of linen, each  $22\frac{1}{2}$  yards at 16 $\frac{1}{2}$ d; and 54 pieces stuffs, each 30 yards at 14d; he advises the sales at 713 and 624 rees per yard, and that he has shipped, in return, 15 pipes of wine; amount, per invoice, 1470 milrees; required how much my Factor still owes me, allowing him  $3\frac{1}{2}$  per cent. commission; and also how much I gain upon the whole, supposing, that besides clearing freight and charges, I dispose of the wine at 10 per cent. advance on the invoice, ex. 5s 8 $\frac{1}{2}$ d?

### INVOLUTION, OR RAISING OF POWERS.

INVOLUTION is the multiplying of a number into itself, any required number of times.

The number to be involved is itself the first power; or it is called the root of that power, it is required to be raised to. If it be multiplied once into itself, the product is its square or second power. If twice into itself, the product is its cube or third power; and, universally, any power of any number is obtained by multiplying the number into itself a number of times, less by unity than the index, or number of the power, to which it is required to be raised.

*Table of the second and third powers of the nine digits.*

First power or root	1	2	3	4	5	6	7	8	9.
Second power or square	1	4	9	16	25	36	49	64	81.
Third power or cube	1	8	27	64	125	216	343	512	729.

- Ex. 1. Raise 23 to the biquadratic, or fourth power.  
 2. Raise 31 to the sursolid, or fifth power.  
 3. The lineal side of a square table was 38 inches; how many square inches did it contain?



4. The lineal side of a stone of a cubic form measures 5 feet; how many solid feet does it contain?
5. How many  $\frac{1}{2}$  inch cubes will I get out of a 9 inch cube?

## EVOLUTION, OR EXTRACTION OF ROOTS.

EVOLUTION, the reverse of INVOLUTION, is the finding the root of any given number.

### *General Rules.*

1. When the root of any number is to be extracted, it must be divided into periods of as many figures each, as the index of the root to be extracted, beginning at the place of units, and pointing towards the left hand in integers, and towards the right hand in decimals.
2. If there is a remainder after all the periods are used, the root may be continued to a decimal of any desired number of places, by annexing periods of cyphers.
3. Any figure of the root is integral or decimal, according as the period it arises from consists of integers or decimals.
4. To extract the roots of vulgar fractions; extract the root of each term, if it can be exactly done; if not, as is most frequently the case, reduce them to decimals; the roots of which are extracted in the same manner as integers.

### *Extraction of the Square Root.*

*Rule,* Point the number into periods of two figures each. Find by trial, or the above table, the greatest square number contained in the left-hand period; place its root in the quotient, and subtract the number itself from said left-hand period; and to the remainder annex the next period for a dividend. Write the double of the part of the root found on the left-hand of the dividend, which divide by it, omitting the right-hand figure: Place the quotient as the second figure of the root, and annex it also to the divisor: Multiply the divisor, thus increased, by the last figure placed in the root: Subtract the product from the dividend, and to the remainder annex the next period for a new di-

vidend; with which proceed in the same manner, and so on, till all the periods are used.

- |                                    |  |
|------------------------------------|--|
| 1. Required the square root of 576 | 14. Required the square root of 6154346                                    |
| 2. — of 20736                      | 15. — of 5   |
| 3. — of 622521                     | 16. — of 173056  |
| 4. — of 788544                     | 17. — of 8281  |
| 5. — of 1234321                    | 18. — of $\frac{49}{144}$ , of $\frac{81}{144}$ , and of $\frac{529}{144}$ |
| 6. — of 5013914481                 | 19. — of $\frac{1}{4}$   |
| 7. — of 95023504                   | 20. — of 000729  |
| 8. — of 15241578750190521          | 21. — of 784375  |
| 9. — of 65131436864025             | 22. — of 683   |
| 10. — of 5329                      | 23. — of 4861  |
| 11. — of 5875                      | 24. — of 00000784  |
| 12. — of 487683                    | 25. — of 11  |
| 13. — of 914874                    | 26. — of 000000005329  |

Prob. 1. To find a mean proportional between two given numbers; extract the square root of their product.

1. Required a mean proportional between 4 and 36?
2. ————— between 7 and 135?

Prob. 2. To find the side of a square equal in area to any given superficies; extract the square root of the given area.

3. The area of a circle is 7854; required the side of a square equal in area thereto?
4. A gentleman has a fish-pond, in form of a triangle, containing 480 poles, he wants another of equal area, in form of a square; required its side?
5. A plantation of an irregular form contains 6400 poles, another of a square form is wanted three times as large; required the length of its side?
6. A clergyman's glebe consists of four fields, the 1<sup>st</sup>, 2 acres 3 roods 4 poles—2<sup>d</sup>, 3 acres 1 rood 20 poles—3<sup>d</sup>, 1 acre 15 poles—4<sup>th</sup>, 4 acres 3 ro. 24 poles; he wants a square field in exchange equal in area to all the four; required the length of its side?
7. A gentleman has two fields, the first 7 acres 2 roods 8 poles, the second 5 acres 2 roods 24 poles; he wants to exchange

them with a square field of inferior quality, but one half larger; Quere the side of the square?

8. In a square plantation containing 74529 trees, the trees are planted 18 feet distant; required the length of the side?
9. There are two circular walks in a gentleman's pleasure ground, the diameter of the one is 60 yards, and the other is five times as large; required its diameter?
10. I planted 6512490 trees in a grove whose length was ten times its breadth; required the number of trees in its length and breadth?
11. A gentleman has two elliptical ponds, the area of the one is 3 acres 2 roods, the other 1 acre 2 roods 20 poles; he wants a square canal three times as large as both; required the length of its side?

Prob. 3. Given any two sides of a right angled triangle to find the other side. The square of the hypotenuse or longest side, is equal to the sum of the squares of the other two sides: Therefore, the hypotenuse is equal to the square root of the sum of the squares of the two sides; and either side is equal to the square root of the difference of the squares of the hypotenuse and other side?

12. The three sides of a right angled triangle are 3, 4, and 5, taking any two of them as given; required the other?
13. The length of a line stretched from the top of a steeple to a station 250 feet from its bottom was found to measure 330 feet; Quere the height of the steeple?
14. Standing on the side of a river, I found that a line stretched from the top of a precipice, rising perpendicularly 449 feet on the other side, measured 585 feet; required the breadth of the river?
15. The wall of a fortification is 248 feet high, the breadth of a ditch surrounding it is 224 feet; required the length of a scaling ladder that will reach from the farther side of the ditch to the top of the wall?
16. Two men travelled from the same place, the one north 25 miles *per* day, the other west 32 miles; how far were they distant after travelling 5 days?
17. Straight in a line betwixt two trees stands a statue, that part of which, which is level with the bottom of the trees,

is just 90 feet from the top of each : The one tree plumbs 54 feet, the other 60 feet, they stand on the opposite banks of a canal ; required its breadth ?

### EXTRACTION OF THE CUBE ROOT.

*Rule,* Divide the number into periods of three figures each. Find the greatest cube number in the left-hand period, put its root for the first figure of the root sought, and subtract the number itself from said left-hand period ; and to the remainder annex the next period for a dividend.

Find a divisor, by multiplying the square of the part of the root found by 300, divide the dividend by it ; and put the quotient figure for the next figure of the root.

Multiply the part of the root formerly found by the last figure placed in it, and this product by 30 ; place this last product under the divisor : And, lastly, under this product, write the square of the figure last placed in the root.

Multiply the sum of these three by the figure last placed in the root, and subtract the product from the dividend. To the remainder annex the next period for a new dividend, with which proceed as before.

- |                                    |   |
|------------------------------------|---|
| 1. Required the cube root of 15625 | 10. Required the cube root of 484846678016                                      |
| 2. — of 21024576                   | 11. — of 6784   |
| 3. — of 52734375                   | 12. — of 78358748   |
| 4. — of 490982336369               | 13. — of 3  |
| 5. — of 1371737997260631           | 14. — of 000000091125   |
| 6. — of 67459354004042485129       | 15. — of 78467341688  |
| 7. — of 219365327791               | 16. — of 70846  |
| 8. — of 344237608531512161929      | 17. — of 00091855945728   |
| 9. — of 041063625                  | 18. — of $\frac{216}{12^3}$ , of $\frac{125}{5^3}$ , and of $\frac{1728}{12^3}$ |
|                                    | 19. — of 7.   |
20. The solidity of a sphere is 11390.625 ; required the lineal side of a cube of equal solidity ?
21. The lineal side of a cubic piece of marble measured 36 feet ; required the side of a piece  $6\frac{1}{2}$  times as large ?

22. A mound of earth is 660 feet long, 120 feet broad, and 208 feet deep; required the side of a cubic one equal to it?
23. If a globe of 8 inches diameter weighs 18 lb.; what will be the diameter of another weighing 162 lb.?
24. The length of a rect angular cistern is 4 feet, breadth 3 feet 4 inches, and depth 30 inches; required the dimensions of another three times as large?

## PROGRESSIONS.

An arithmetical progression is a series or rank of numbers uniformly increasing or decreasing, by the constant addition or subtraction of some number called the common difference: Thus 1, 2, 3, 4, 5. is an increasing arithmetical series where the common difference is 1, and 10, 8, 6, 4, 2. is a decreasing arithmetical series where the common difference is 2.

A geometrical progression or series is a rank of numbers uniformly increasing or decreasing, by a constant multiplier, or divisor, called the common ratio; thus 1, 2, 4, 8. is an increasing geometrical series where the common ratio is 2, and 27, 9, 3, 1. is a decreasing geometrical series where the common ratio is 3.

The first and last terms are called extremes, and the other terms means.

### *Arithmetical Progression.*

Of these five, viz. The two extremes, common difference, number of terms, and sum of the series; having any three given the other two may be found.

Theor. The sum of the extremes is equal to the sum of any two means equally distant from them.

Prob. 1. Given the extremes and number of terms to find the other two.

Rule, The common difference is equal to the difference of the extremes divided by the number of terms minus one. And the sum of the series is equal to the sum of the extremes multiplied by half the number of terms.

1. Given the extremes, 12 and 42, and the number of terms 11; required the common difference, and sum of the series?
2. A person owed a certain sum which he paid in 13 different payments, increasing in arithmetical progression, the first payment was 3s, the last 2l 11s; how much did each payment exceed the former, and how much did he owe in all?
3. A farmer bought 100 sheep, and gave for the first 1s, for the last 19l 17s; what did he give for the whole, and how much did the price of any one exceed that of the preceding?

Prob. 2. Given the extremes and common difference; required the number of terms and sum of the series.

*Rule 1.* Divide the difference of the extremes by the common difference; the quotient plus one, will be the number of terms.—*2.* Divide the difference of the squares of the extremes by twice the common difference, and this quotient added to half the sum of the extremes will give the sum of the series.

4. Given the extremes 7 and 103, and the common difference 4; required the number of terms and sum of the series?
5. A nursery-man planted a number of firs in form of an isosceles triangle, he put one plant in the first row, 3 in the second, and so on in arithmetic progression, the last row contained 61 plants; required the number of rows, and the whole number of plants?
6. A person meeting with a number of poor people gave the first 2d, the second 5d, and so on until the last, to whom he gave 2s 8d; required the number of poor people, and how much they received in all?
7. A person travelling from one city to another went 6 miles the first day, 9 the second, and so on in arithmetical progression, his last day's journey was 60 miles; required the number of days he travelled, and the distance of the cities?

Prob. 3. Given the common difference, number of terms, and sum of the series, to find the rest.

*Rule,* Divide the number of terms minus 1, by 2 ; multiply the common difference by the quotient : Add and subtract this product to and from the sum of the series, divided by the number of terms ; the sum and remainder will be the greater and less terms respectively.

8. Given the number of terms 9, the common difference 2, and the sum of the series 135 ; required the extremes ?
9. A person discharged a debt of 210*l* 12*s* in a year, by paying every week 3 shillings more than he did the preceding ; Quere the first and last payments.

*Prob. 4.* Given either of the extremes, the common difference, and number of terms, to find the rest.

*Rule,* Multiply the common difference by the number of terms, minus 1 ; this product added to the less extreme gives the greater, or subtracted from the greater extreme leaves the less.

Add said product to twice the least extreme, or subtract it from twice the greater ; multiply the sum or remainder by half the number of terms, either of these will give the sum of the series.

10. Given the least extreme 12, common difference 3, and number of terms 11 ; required the greater extreme, and sum of the series ?
11. Given the greater extreme 123, common difference 5, and number of terms 24 ; required the less extreme, and sum of the series ?
12. A sum of money was divided among 12 persons whose shares were in arithmetical progression, the first received 3*s*, the second 7*s*, and so on ; required the sum divided among them, and the share of the last ?
13. A traveller sets out on a journey which he accomplishes in 15 days by travelling every day 3 miles more than he did the preceding, and travelling 49 miles the last day ; required how many miles he travelled the first day, and the length of the journey ?

*Geometrical Progression.*

**Theor.** The product of the extremes is equal to the product of any two means equally distant from them.

**Prob. 1.** Given the least extreme, ratio and number of terms, to find the greater extreme, or any distant term.

**Rule,** Raise the common ratio to a power less by unity than the number of the required term; multiply that power by the least term, the product is the greatest.

14. Given the least term 3, the ratio 2; required the 8th term?

15. Given the least term 5, the ratio 3, number of terms 6; required the greatest?

16. A merchant bought 12 yards of cloth at the price of the last yard, reckoning 1d for the first, 2d for the second, and so on in geometrical progression; required how much he paid?

17. A farmer bought 15 oxen for the price of the 10th, reckoning 2d for the first, 6d for the second, &c. How much did he give, at an average, for each?

**Prob. 2.** Given the extremes and ratio to find the sum of the series.

**Rule,** Multiply the last extreme by the ratio; from this product subtract the first extreme, and divide the remainder by the ratio minus 1.

18. Given the extremes 1, and 2187, and ratio 3; required the sum of the series?

19. What debt will be discharged by weekly payments of which the first is 5s, the last 2048l, the ratio being 2?

## ALLIGATION.

**ALLIGATION** directs computations relating to the mixing of simples of different qualities, and is distinguished into *medial* and *alternate*.

**ALLIGATION MEDIAL.** Given the quantities and rates of the several simples to find the rate of the mixture.



*Rule,* Multiply each quantity by its rate, and divide the sum of the products by the sum of the quantities.

1. Eight lbs of sugar at  $7d$  per lb. was mixed with 5 lb. at  $8d$ , and 7 lb. at  $1s$ ; what was the price of the mixture per lb.?
2. 8 lb. tea at  $5s\ 7\frac{1}{2}d$  was mixed with 12 lb. at  $8s\ 3d$  and with 16 lb. at  $9s$ ; required the value of a lb. of the mixture?
3. If 7 gal brandy at  $6s\ 3d$  be mixed with 9 gal. at  $7s\ 6d$ , 12 gal. at  $7s\ 11\frac{1}{2}d$ , and 4 gal. at  $10s\ 3d$ ; what is the mixture worth per gallon?
4. If 9 gal. wine at  $5s\ 4d$  be mixed with 8 gal. at  $6s\ 8d$ , 8 gal. at  $7s\ 7d$ , and with three of water; what is the value of the mixture per gallon?
5. A compounder of spirits mixes 18 gal. at  $3s\ 6d$  with 12 gal. at  $5s\ 7d$ , and 16 gal. at  $4s\ 4d$ ; at what must he sell the compound that his gain may be 10 per cent.?

**ALLIGATION ALTERNATE.** Given the rates of the mixture and simples to find the quantity of each simple.

*Rule,* Write the rates of the simples under each other, with the mixture rate on their left-hand. Connect the rates of the simples, so that one less than the mixture rate be always linked with one that is greater. Write the difference betwixt the mixture rate and that of each of the simples opposite to that rate with which it is linked. These differences, or their sum if more than one, will be the quantities at the rates opposite to which they stand.

6. How much corn at  $2s\ 6d$  per bushel and  $3s\ 4d$  per bushel must be mixed together, that the compound may be worth  $3s$  per bushel?
7. How much tea at  $3s$  and  $2s$  must be mixed together to form a composition worth  $2s\ 6d$ ?
8. How much sugar at  $4d$ ,  $6d$ , and  $9d$ , must be mixed together that the composition may be worth  $8d$ ?
9. How much wine at  $4s$ ,  $5s$ ,  $6s$ , and  $8s$ , must be mixed together that the compound may be worth  $7s$ ?

*Note,* If the composition be limited to a certain quantity, say, As the sum of the quantities, found as above, :: to the gi-

*ven quantity : : so is each of the quantities found : to the required quantity of each.*

10. How much brandy at 4s, 5s, and 6s per gallon must be mixed to form a composition of 24 gal. worth 5s 6d?
11. How much snuff at 4s, 6s, and 9s per lb. must be mixed together to form a composition of 40 lb. worth 7s per lb.?

*Note 2. If one of the simples be limited, say, As the quantity of that simple found by the method of linking : is to the limited quantity, : : so are the other quantities found : to the required quantity of each.*

12. How much wine at 4s, 6s, and 7s per gal. must be mixed with 6 gal. at 5s per gallon, that the mixture may be worth 5s 6d per gallon?
13. How much corn at 7s, 9s, and 10s per bushel must be mixed with 6 bush. at 8s per bush. that the mixture may be worth 8s 6d per bushel?
14. How much brandy at 5s, at 5s 6d, and at 6s per gallon must be mixed with 3 gal. at 4s per gal. that the compound may be worth 5s 4d per gallon?

## POSITION.

In this rule take any convenient number and proceed with it according to the tenor of the question, if the result or number thus obtained be the same as the given number, the position or assumed number is the number sought, if not, proceed by the following rules.

*Rule 1st,* When the result is proportional to the position, the result : is to the given number : : as the position : to the required number.

1. What number is that to which if we add the half, the third and fourth of itself, the sum will be 125?
2. A Jockey being asked the value of his horse said, that if from his value you take  $\frac{1}{2}$  and  $\frac{1}{4}$  thereof, the remainder will be 15; required what he valued his horse at?
3. A man being asked his age said, If to my age you add  $\frac{1}{2}$ ,  $\frac{1}{4}$ ,  $\frac{1}{6}$ , thereof, the number 63 will then be had; Quere his age?

4. Required a number to which  $\frac{1}{3} + \frac{1}{4}$  of itself being added, and  $\frac{1}{5}$  of the sum subtracted, the remainder shall be 76?
5. The number of fruit-trees in a garden were 252, there were  $\frac{1}{3}$  more bearing apples than pears; the number of those bearing plumbs were  $\frac{2}{3}$  of those bearing pears; and the number of those bearing cherries  $\frac{1}{4}$  of those bearing plumbs; how many were there of each?

*Rule 2.* When the results are not proportional to the position; that is, when some given number is added to, or subtracted from the position in the course of the process; try two numbers, as above, and find the errors or differences between the results and the given number: Multiply each of these errors by the other's position; then if the errors be of the same kind; that is, both less, or both greater than the given number; divide the difference of the products by the difference of the errors; but if the one error is greater, and the other less than the given number; divide the sum of the products by the sum of the errors; the quotient in each case will be the answer.

6. What number is that which being doubled, and 16 added to the product, the sum shall be 56?
7. Three men, A. B. and C. have 36l to be divided among them, so that B's share is 4l more than  $\frac{2}{3}$  of A's, and C's 5l more than  $\frac{1}{2}$  of B's; required their shares?
8. What number is that which, being multiplied by 7, and lessened by 30, if the remainder be divided by 5, the quotient will be the same as the required number?
9. A person mixes 60 gallons of wine, part worth 8s per gallon, and the remainder worth 10s; so that the value of the mixture is 8s 10d; required the quantity of each?
10. A politician, having about him a certain number of crowns, said, if  $\frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6}$  of what he had were added to 10, the sum would just make Wilkes's number (45); required the number of crowns?
11. A gentleman serving some beggars, found that if he gave each 4d he would have 8d left; but if he gave each 5d, he would want 4d; how many beggars were there?

## DUODECIMALS, or MULTIPLICATION OF FEET AND INCHES.

*Note,* A foot is divided into 12 inches, an inch into 12 parts or primes, a prime into 12 seconds, &c.

*Rule,* Write the multiplier under the multiplicand; feet under feet, inches under inches, &c.

*First,* Multiply the multiplicand, beginning at the lowest denomination, by the feet in the multiplier; and place each product under that denomination of the multiplicand from which it arises; always carrying at 12. Next, multiply by the inches, and set each product a place farther towards the right hand. *Lastly,* Multiply by the parts, and set each product another place towards the right hand.

1. 48 ft 6 in. $\times$ 3 ft 4 in.	12. 83 ft 4 in. 5 p. $\times$ 9 ft 10 in.
2. 98 3 $\times$ 5 6	13. 87 11 11 $\times$ 11 11
3. 548 5 $\times$ 7 11	14. 78 11 4 $\times$ 7 8 3 p.
4. 141 6 $\times$ 6 10	15. 63 4 8 $\times$ 8 9 6
5. 891 5 $\times$ 9 8	16. 91 4 9 $\times$ 9 7 9
6. 146 3 $\times$ 8 9	17. 33 0 8 $\times$ 7 6 8
7. 678 ft 4 in. 8 p. $\times$ 7 ft 11 in.	18. 55 8 7 $\times$ 72 0 8
8. 37 6 9 $\times$ 11 10	19. 77 11 8 $\times$ 37 11 8
9. 35 11 10 $\times$ 10 11	20. 88 10 4 $\times$ 48 10 0
10. 67 8 11 $\times$ 9 11	21. 73 5 8 $\times$ 33 6 4
11. 87 6 8 $\times$ 11 10	22. 96 8 9 $\times$ 55 11 9

*N. B.* Mensuration is either lineal, superficial, or solid.

Lineal mensuration respects mere length, and is found by applying a ruler of a known length. Superficial measure respects the face or surface of any thing, and is found by multiplying the length into the breadth; and therefore if the two factors, in the above examples, be considered as the lengths and breadths of windows, deals, &c.; then will the several products express the measures of the surfaces, or superficial areas, of these things. Solid measure is computed by multiplying the length into the breadth, and that product into the thickness or height.

23. In a deal 57 feet 8 inches long, 2 feet 7 inches 3 pr. broad; how many superficial feet?
24. How many feet in the floor of a room 46 feet 8 inches long, and 25 feet 4 inches broad?

25. The floor of a room measured 74 feet 10 inches by 53 feet 3 inches ; required its superficial content ?
26. A window measured 7 feet 8 inches 6 pr. by 4 feet 9 inches 8 pr. ; how many superficial feet does it contain ?
27. What is the solid content of a stone 3 feet 11 inches thick, 7 feet 9 inches broad, and 13 feet 8 in. long ?
28. The dimensions of a piece of mahogany are 7 feet 8 inches 3 primes, 9 feet 5 inches 4 p. and 58 feet 6 inches ; required its solid content ?
29. Required the superficial and solid content of a wall 37 feet 8 inches long, 7 feet 9 inches high, and 2 feet 10 inches thick ?
30. What is the solid content of a block of marble, whose three dimensions are 4 feet 8 inches, 3 feet 11 inches, and 2 feet 3 inches ?
31. How many gallons of water (wine measure) will a cistern contain, whose inside dimensions are 38 feet 6 inches, 23 feet 4 inches, and 11 feet 9 inches ?
32. How many gallons of ale will another, whose dimensions are double of the former, hold ?
33. Required the number of feet in a plank of wood 16 feet 11 inches long,  $3\frac{1}{4}$  feet broad, and 2 feet 10 inches 4 parts thick ?
34. A log of wood, 14 feet 10 inches long, was sawed into 7 deals, each 2 feet 11 inches broad ; how many superficial feet did they contain ?
35. How many feet are there in 5 deals 12 feet 8 inches long, and their breadths 2 feet 2 inches, 2 feet 8 inches, 3 feet 5 inches, 3 feet 9 inches, and 3 feet 11 inches ?
36. What is the difference of the areas of the floors of two rooms, the one 36 feet 7 inches by 22 feet 10 inches, the other 27 feet 11 inches by 19 feet 7 inches ?
37. What is the solid content of a box 7 feet 9 in. 3 p. long, 2 ft 3 in. 6 p. broad, and 1 ft 11 in. 11 p. thick ?

## MISCELLANEOUS QUESTIONS.

1. London consumes annually 98245 black cattle, suppose at 18 guineas each ; 711124 sheep and lambs, suppose at 35s ; 194770 calv. 23s, 186934 swine at 46s, 115536 pigs at 15s 6d, 14740100 bushels of oysters at 17s, 1398 boats of various kinds of other fish at 3 guineas a boat, 16000000 lb.

butter at  $8\frac{1}{4}d$ , 20000000 lb. cheese at  $6\frac{1}{4}d$ , 7000000 gal. milk at  $8d$ , 1172494 bar. strong beer at  $36s$ , 798495 small beer at  $14s$ , 3044 ton wine at  $9s$  per gal. 11000000 gal. spirits at  $7s$   $6d$ , 11000000 lb. candle at  $7\frac{1}{2}d$ . How much does London lay out annually on these articles?

2. In a shoal of herrings 7 miles in length,  $2\frac{1}{2}$  in breadth, and 350 yards deep; how many herrings, allowing 172 to a solid foot; and how many casks would they fill, each containing 815?
3. 20*l*  $6d$  is to be divided among four classes of poor people; there are 7 in the first class, 9 in the second, 15 in the third, and 20 in the fourth; the share of the first is double that of the second, the second triple that of the third, and the third quadruple that of the fourth; required the share of each class?
4. A dealer in cloth carried to market  $27\frac{1}{2}$  yards, which he sold at  $2s$   $11\frac{1}{4}d$ ;  $35\frac{1}{2}$  yards, of which he sold 26 yards at  $15s$   $10\frac{1}{4}d$ , and the remainder at  $15s$   $7\frac{1}{2}d$ ; 25 yards, which he sold at  $5s$   $3\frac{1}{4}d$ ; 3 pieces, each  $26\frac{1}{2}$  yards, of which he sold  $52\frac{1}{2}$  yards at  $6s$   $8\frac{1}{4}d$ , and the remainder at  $6s$   $9\frac{1}{4}d$ ; His expences amounted to  $13s$   $6d$ ; and also paid a bill of  $3*l*$   $17s$   $6d$ . How much cash did he bring home, supposing he had two marks and a noble when he went away?
5. A miller bought 1100 qrs of wheat at  $35s$   $6d$ , and 175 qrs barley at  $22s$ ; the wheat produced  $2\frac{1}{2}$  stone flour per bushel, which he sold at  $23\frac{1}{2}d$  per stone; the barley produced  $2\frac{1}{2}$  stone per bushel, which he sold at  $19\frac{1}{2}d$  per stone. Required his gain upon the whole, allowing  $4*l*$   $13s$  for grinding and other expences?
6. A farmer possesses 24 acres at  $25s$  per acre, which is laid out in four equal divisions: The  $\frac{1}{4}$  is sown in wheat, and produces 5 qrs per acre at  $37s$ ; seed 6 bushels per acre— $2d$ , Barley produces 5 qrs at  $25s$ ; seed  $3\frac{1}{2}$  bushels— $3d$ , Oats produce  $4\frac{1}{2}$  qrs at  $16s$ ; seed 5 bushels— $4th$ , Grass produce in whole 160 stone hay at  $4\frac{1}{2}d$  per stone. What has the farmer for his expence of time and labour?
7. If an acre of ground produces  $4\frac{1}{2}$  qrs wheat, and each peck gives 20 lb. of bread; how much ground will be necessary to supply a city of 5000 families with bread for a year, supposing each family uses 12 lb. per day: And how much would supply all the inhabitants of Britain with bread

for the same time, taking their number at 8000000, and allowing each person  $1\frac{1}{2}$  lb. *per* day?

8. A merchant sold 8 pieces of linen, each 27 yards at  $3s\ 7d$  *per* yard; 78 yards cotton at  $1s\ 3d$ ; 4 pieces corduroys, each 30 yards at  $2s\ 7d$ ; 5 pieces velverets, each 37 yards at  $3s\ 2d$ ; but the buyer being desirous of a year's credit, is willing to allow 5 *per cent.* for it; how much will he have to pay at the end of the year?
9. Bought a quantity of cloth at  $412l\ 10s$ ; 85 yards getting damaged was sold at  $15s$ , whereby I lost  $6l\ 7s\ 6d$ ; but sold the remainder so as to gain  $17l\ 16s\ 8d$  upon the whole; required the quantity bought, and at what the undamaged part was sold?
10. A bankrupt owed to his three creditors  $48l\ 15s$ ,  $72l\ 10s$ , and  $84l\ 13s\ 4d$ ; his effects amounted to 100*l.* It is required to divide it among his creditors according to their claims?
11. Received 125 yards of cloth at  $5s\ 6d$ ; for 215 lb. tea; required the price of the tea?
12. A. has 13 cwt 21 lb. of hops at  $35s$  *per* cwt, which he would barter with B for 3 joannes, 7 half-guineas, 4 moidores, and brandy at  $11s\ 6d$  *per* gallon; how much brandy must be given?
13. Bought goods to the value of 360*l.*, and sold them at 400*l.*, payable in 6 months; what was my gain, or loss?
14. A. barter with B. 16 pieces of cloth, each 25 yards at  $10s$  *per* yard, for 64 stone wool at  $14s$  *per* stone, and 80*l.* in cash; the balance is to be paid in cotton at  $9d$  *per* lb.; how many lb. must be given?
15. A. gives B. 3 cwt 3 qrs 15 lb. of tea at  $6d$  *per* oz. for 6 hhds 22 gallons of wine; how was the wine rated *per* gallon?
16. A. barter with B. tea worth  $5s\ 6d$  at  $6s\ 3d$ , for rum worth  $7s$  at  $7s\ 11d$ ; who has the advantage, and how much?
17. C. barter with D. 3 cwt of tea worth  $7s$  *per* lb. at  $7s\ 4d$ , with cloth worth  $2s\ 4d$  at  $2s\ 6d$ ; who had the advantage in barter, and how much cloth did C. get?
18. A pipe of wine containing 55 dozen may be sold presently at  $39s$  *per* dozen; or  $2\frac{1}{2}$  years hence at  $46s\ 6d$  *per* dozen; but besides losing the interest at 5 *per cent.* the

- leakage will be  $2\frac{1}{2}$  doz. and other charges 17s; required the gain, or loss, by keeping it?
19. A. values cloth in barter at 6s 3d, worth only 5s 9d; how must B. value cloth worth 7s 2d to be even with him?
20. A. barter with B. 102 lb. tea at 4s 9d, 36 lb. ditto at 3s 6d, and 54 lb. ditto at 7s 4d, for 546 lb. sugar at 3l 8s *per* cwt, 735 lb. ditto at 4l 16s, and the balance in cash; required how much cash was given?
21. A woollen manufacturer sold 3 pieces broad cloth, each 27 yards at 17s 3d; and 5 pieces narrow ditto, each 31 yards at 11s 7d; he allows 5 *per cent.* discount for prompt payment; what did he receive?
22. Bartered  $56\frac{1}{2}$  lb. tea at 11s 5d, with tobacco at 7l *per* cwt; how much tobacco did I receive, and at what rate *per* lb.?
23. Bartered 3 puncheons of rum and 12 ankers of brandy, with 17 cwt 3 qrs 23 lb. tobacco at 6l 18s *per* cwt, and 5 cwt 19 lb. of sugar at 15s 6d *per* qr; required the price of the brandy and rum *per* gallon, the brandy being dearest by  $1\frac{1}{2}$  *per* gallon?
24. A. barter with B. 750 qrs of wheat at 39s 6d *per* qr, with 540 qrs barley, and 760l 10s of money; what was the price of the barley?
25. A butcher agrees with a grazier to feed 30 oxen for 2 years at 3l 5s each, but at the end of 3 months the butcher adds 6 more, and at the end of 6 months 9 more; how long may the whole be continued for the sum already stipulated, or what will be due the grazier if the whole are continued to the end of the twelve months?
26. The average price of the 30 oxen was 4l 5s, of the six 5l 18s, of the nine 6l 14s, and after fulfilling the original agreement, he feeds each with 18 pecks of corn at 16s 4d *per* qr, and 24 trufs of hay at 1s 2d *per* trufs; he slaughters them, and their average, weight and price, was as follow, *viz.* Beef 32 stone at  $3\frac{1}{4}$ d *per* lb. tallow 5 stone at  $6\frac{1}{2}$ d *per* lb.; hide one guinea; required the gain, or loss?
27. A contractor engages to supply a ship with provisions, and receives 15s *per* month of 28 days for each private man, thrice as much for each officer, and 6 times as much for the captain. The crew consists of the captain, 8 officers, and 160 private men. He provides 35 bar. beef at 35s 6d, 16 ditto pork at 52s, 8 ton  $15\frac{1}{2}$  cwt of bread at



- 25s *per* cwt, 82 bushels of pease at 5s, 26 cwt 2 qrs 21 lb. cheese at 30s *per* cwt, 18 cwt 3 qrs 16 lb. butter at 3/ 14s 8d *per* cwt, 26½ qrs oat-meal at 19s, 8 cwt fish at 26s, other small charges amount to 1/ 7s 3½d; at the return of the ship he finds his profit is 185/ 5s 5d. How long was the voyage?
28. Imported 120 jars of oil, each containing 1180 solid inch. (231 inches = 7½ lb.) ; what came the freight to at 5s 3d *per* cwt, deducting tare at 7 lb. *per* cwt?
29. A privateer, consisting of a captain, first and second mates, a surgeon, a carpenter, 52 sailors, and 42 mariners, took a prize of 31235½, of which the proprietors are to have ⅔; and of the remainder the captain is to have nine shares; the first mate, surgeon, and carpenter, each 6½ shares; the second mate 5 shares; each sailor 1¼ share; each marine ⅙ of a share. How much will each get?
30. What was that gentleman's yearly income, who lets his estate of 19602 Scots acres at 1¼ nobles *per* Eng. acre?
31. A father left his estate to his wife and three sons as follows: To his eldest son ⅔ wanting 140/, to his second son ⅔ plus 20/, to his youngest son ⅔ wanting 220/, and to his wife ⅔; required his estate, and the share of each?
32. A bankrupt's effects amounted to 1850/, it is required to divide it among his six creditors, whose shares were to each other as the numbers 3, 5, 7, 9, 11, 13?
33. Four men A, B, C, and D, got a present of a guinea, of which A. claims ⅔, B ⅔, C ⅔, D ⅔, but find it too little; it is required therefore to determine their shares of it in the above proportion?
34. Three men E, F, and G, enter into company, E continued his share of the stock for 4 months, and claimed ⅔ of the profits, F's continued 9 months, G continued his stock of 550/ for 8 months, and required ⅔ of the gain; required E and F's stocks?
35. Suppose an wolf could devour a sheep in an hour, a tyger in ⅔ hour, and a lion in ⅔ hour; and that the wolf eats 10 minutes by himself, after which the tyger arrives and eats along with him 10 minutes longer, then the lion arrives and all three eat together; required the time in which the sheep will be devoured?
36. Sent as an adventure to Denmark 300 pieces of linen, each 25½ yards, bought at 19½d *per* yard, the freight is 3½d

*per piece*, duty there  $3\frac{3}{4}$  sch. *per yard*; the whole is sold at 3 mar. 12 sch. *per yard*; how much did I gain, or lose, allowing my factor  $2\frac{1}{2}$  *per cent.* com. and ex.  $5\frac{1}{2}$  rix dollars?

37. Configned to my factor in Amsterdam 27 hhds tobacco, 12 cwt 1 qr 8 lb. each, which *per advice* is sold at  $21\frac{1}{2}$  fl. *per lb.*; how much sterling may I draw for allowing  $8\frac{1}{2}$  *per cent.* for com. and charges, ex.  $35s$  9d?
38. L. of London remits to B. of Hamburg ml. 2000, exch.  $35s$   $4\frac{1}{2}$ d, payable in 2 months, at the end of which B. remits the value to L. deducting  $\frac{1}{2}$  *per cent.* com. in a bill of 4 months date, ex.  $34s$   $2\frac{1}{2}$ d; required L's gain, or loss, interest at 4 *per cent.*?
39. Configned to my factor at Hamburg 13 hhds sugar, each 7 cwt 3 qrs 18 lb. which *per account* of sales is sold at  $5\frac{1}{2}$  fl. *per lb.*; how much sterling will my factor remit me, retaining 8 *per cent.* for com. charges and bad debts, agio 20 *per cent.* ex.  $35s$   $6\frac{1}{2}$ d?
40. London owes Madrid 5000 rial plate; it may be remitted directly, ex.  $44\frac{1}{2}$ . Or by way of Amsterdam, ex. between London and Amsterdam  $36s$  9d com. there  $\frac{1}{2}$  *per cent.* ex. between Amsterdam and Madrid 112. Or by France, ex. between London and Paris  $28\frac{1}{2}$ , com.  $\frac{1}{4}$  *per cent.* and between Paris and Madrid  $18\frac{1}{2}$ ?
41. P. of Portugal may draw on B. of Britain for 2000 milrees at  $5s$  8d. Or on H. of Holland, ex.  $50\frac{1}{2}$ d *per crusado*, who will draw on B. of Britain for the value including  $\frac{1}{4}$  *per cent.* com. ex.  $36s$  10d. Or on R. of Paris, ex. 433 rees *per crown*, who will draw on B. com.  $\frac{1}{2}$ , ex. 29; required which way is cheapest?
42. The rent of a fishery is 360l; the tenant employs 8 men at 10d *per day*, and an overseer at double wages; the fishermen have also  $\frac{1}{7}$  of the fish: The fishing season continues 249 work days, and they catch, at an average, 250 fish in eight days—weight, at an average, 8 lb. each. The expence for boats and nets is 60l; the fish are packed in barrels, each containing 300 lb. price of the barrels 2s 6d, salt 1s 6d; required at what they must be sold *per barrel*, that the tenant's gain may be  $\frac{1}{7}$  of the whole?
43. A city is supplied with water brought in pipes from three different fountains at the distance of  $1\frac{1}{2}$  miles,  $2\frac{1}{2}$  m. and  $2\frac{1}{2}$  miles respectively; each foot of pipe weighs 12 lb.

- at  $2\frac{1}{2}d$  *per* lb.; expence of laying them is  $13d$  *per* yard; cisterns and other expences  $45\frac{1}{3}l$ : 600 of the inhabitants agree to pay as much annually as will amount to the interest of the money expended, at 5 *per cent.* how much must each pay?
44. The diameters of the bores of the pipes are  $4\frac{1}{2}$  inches,  $5\frac{1}{2}$  inches,  $6\frac{1}{2}$  inches; the first runs 4 gallons of water *per* minute, and the quantities supplied by the others are as the squares of their diameters directly. Now it was found that the number of families in the whole city was such, that each (supposing them all to have the same quantity) would have exactly as many gallons *per* day, as the first pipe furnished *per* minute; required the number of families?
45. How much timber are there in a log 3 feet 8 inches by 2 feet 11 inches, and  $37\frac{1}{4}$  feet long?
46. In another 2 feet 10 inches by 1 foot 9 inches, and 33 feet long?
- N. B.* Unequal squared timber, which is larger at the one end than the other, is commonly measured by taking the dimensions in the middle. Round timber is measured by girding it about the middle with a small cord, one fourth of the girt is considered as the side of a square log of equal dimensions. Tapering timber is measured by girding it in two or more places, and dividing the sum of the girts by their number for the mean girt.
47. How much timber in a round tree 27 feet long, and girt in the middle 75 inches?
48. In another 31 feet long, and girt 55 inches?
49. In another 25 feet 6 inches long, and girt 37 inches?
50. In another 37 feet long, and girts in 3 places, 72 inches, 60 inches, and 54 inches?
51. In another 65 feet long, and girts 84 inches, 76 inches, 63 inches, 56 inches, and 46 inches?
52. How many square yards of wainscoting are there in a room 68 feet in circuit, and 11 feet 2 in. high?
53. In another 37 feet long, 25 broad, and 9 feet 8 inches high?

54. In another 74 feet in circuit,  $12\frac{1}{2}$  feet high, allowing work and half for a door 6 feet 9 inches, by 2 feet 10 inches, and for 2 windows with shutters, each 5 feet 8 inches by  $3\frac{1}{2}$  feet, deducting a vacancy for a chimney 6 feet 3 inches by 5 feet 6 inches?
55. How many squares (square = 100 superficial feet) of flooring in a house of 5 floors, 64 feet by 34 within the walls, deducting from each floor the vacancy for the stair 12 feet 3 inches by 8 feet; required also the value at 46s *per* square?
56. How many yards of painting in a room 38 feet long,  $23\frac{1}{2}$  broad, and  $11\frac{1}{2}$  feet high, deducting the chimney 4 feet 8 inches by  $3\frac{1}{2}$  feet; and how much does it come to at 20d *per* yard?
57. How many yards of plastering on a wall 24 feet long and 12 feet 9 inches high?
58. How many in 3 rooms, the first 24 feet by  $16\frac{1}{2}$  feet, the second  $34\frac{1}{2}$  feet by 21 feet 9 inches, the third 40 feet by 34 feet, their common height  $10\frac{1}{2}$  feet, deducting 3 doors, each  $6\frac{1}{2}$  feet by 3 feet; and what is the value, the ceilings being reckoned at 8d, and the walls at 3d *per* yard?
59. How many rood (rood = 36 square yards) of mason-work in a wall 36 feet long, and 15 feet high?
60. How many in a wall 108 feet long, and  $22\frac{1}{2}$  feet high; and how much did it come to at 32s *per* rood?

*N. B.* Two feet is commonly reckoned the standard thickness for stone-walls; and walls of any other thickness must be reduced to it. And one, and one half brick thick, or three half bricks thick, is the standard thickness for brick walls.

61. What is the expence of a wall 27 feet long, 24 feet high, and 3 feet thick, at 30s *per* rood?
62. How many yards of brick-work in a wall 56 feet long, 24 feet high, and  $2\frac{1}{2}$  bricks thick?
63. How many in a wall 125 feet long, and 14 feet 8 inches high, and  $2\frac{1}{2}$  bricks thick?
64. How many feet of hewn work in a stone 13 feet 6 inches by 3 feet 8 inches?

- N. B.* There are three sorts of levers according to the different situations of the power, the fulcrum, or prop, and the weight as in the annexed diagram. Now in all the mechanic powers, the momentum of the power is equal to the momentum of the weight; or in other words, the power multiplied into its velocity is equal to the weight multiplied into its velocity. Therefore, putting  $p$  = power,  $w$  = weight,  $D$  = the distance between the power and fulcrum, and

$d$  = distance between the weight and fulcrum, then

$$p \times D = w \times d, \text{ whence } p = \frac{w \times d}{D}, w = \frac{p \times D}{d}, d = \frac{w \times D}{p}$$

$$\text{and } d = \frac{p \times D}{w}$$

74. Let  $p=5$   $D=100$   $d=10$   $w=50$ , considering any three of these as given; required the others?

75. Let  $p=5$ ,  $D=110$ ,  $d=10$ ,  $w=55$ , considering any three of these as given; required the others?

76. Let  $p=55$ ,  $D=10$ ,  $d=110$ ,  $w=5$ , admitting that any three are given, the fourth is sought?

77. At what distance from the fulcrum of a steel yard must a pound weight be suspended, to balance 3 lb. 4 lb. 5 lb. &c. hung at 4 inches distance on the other?

78. A beam of 8 inches radius, winding a rope with a bucket round it, is driven by help of a wheel of 4 feet radius; what force will be necessary to raise a hhd of water, when a solid foot weighs  $62\frac{1}{2}$  lbs?

*N. B.* A heavy body falling from rest will fall  $16\frac{1}{2}$  feet the first second of time; and as  $16\frac{1}{2}$  feet : to the square of 1 second, :: so is the given distance : to the square of the seconds required.

79. What space will a heavy body, falling freely, pass through in 9 seconds?

80. In what time would a stone falling from the top of a precipice 600 feet high reach the ground?

*N. B.* The degrees and effects of light, heat, and attraction, are reciprocally proportional to the squares of their distances from the centre whence they are propagated.

81. The distance of mercury from the sun is accounted 32 millions of miles, of venus 59 mil. of the earth 81 mil. of mars 123 m. of jupiter 424 mil. of saturn 777 mil.; required the proportion of the sun's light, heat, and attraction on all these bodies?

# PART II.

*Containing Answers to the Questions in Part First, with the principal steps of the more tedious operations.*

## Simple Addition.

- |                     |                     |                  |
|---------------------|---------------------|------------------|
| 1. 45293750         | 13. 210229          | 2. 51 and 38     |
| 2. 258329412        | 14. 25124           | 3. 1732, 1721    |
| 3. 275849956926     | 15. 2024            | 4. 7329          |
| 4. 172486693        | 16. 2024            | 5. 2894          |
| 5. 467607538        | 17. 32209895        | 6. 1653          |
| 6. 100615850        | 18. 5794            | 7. 1261          |
| 7. 364061525        | 19. 1996            | 8. 271, 875      |
| 8. 910634531        | 20. 26468           | 9. 487           |
| 9. 10202566290      | 21. 237m. to. dist. | 10. 1881         |
| 10. 715048145489126 |                     | 11. 1530         |
| 11. 8959706158610   | <i>Subtraction.</i> | 12. 999802151385 |
| 12. 98951852130430  | 1. 4674             |                  |

## Multiplication.

- |                 |                     |
|-----------------|---------------------|
| 78460839        | 15. 7425028227636   |
| 23              | 16. 2958421180572   |
| 235382517       | 17. 2408397120      |
| 156921678       | 18. 4822150080      |
| 1. 1804599297   | 19. 448349273425    |
| 2. 27535765810  | 20. 29062914930     |
| 3. 31624816     | 21. 72027758680     |
| 4. 53055442     | 22. 574585614865    |
| 5. 48964815     | 23. 67254023544     |
| 6. 37012312     | 24. 68118176511     |
| 7. 341591710    | 25. 7378240711125   |
| 8. 659198664    | 26. 456817937112    |
| 9. 50205818     | 27. 549937660552    |
| 10. 29382630    | 28. 32751264000000  |
| 11. 864472245   | 29. 516434316000000 |
| 12. 69748500    | 30. 3853670873940   |
| 13. 2763308592  | 31. 50594581803480  |
| 14. 73997918611 | 32. 326034810684    |
|                 | 33. 59944850490     |
|                 | 34. 2649983000000   |

$$\begin{array}{r}
 35. 2963100000000 \\
 36. 58543382524158 \\
 \quad 7849687 \\
 \quad \quad 6 \times 3 = 18. \\
 \hline
 47098122 \\
 \quad 3 \\
 \hline
 \end{array}$$

1. 141294366
2. 16299552
3. 30329574
4. 47932390
5. 5299672
6. 41358060
7. 62913396
8. 7799936
9. 658538928
10. 874621260
11. 760070976
12. 1627531080

1. 7740 sheaves
2. 2655 letters
3. 33984 legacy
4. 1872 y. inc.
5. 9648 fortune
6. 224 sq. feet
7. 18480 stones
8. 666225000 grs
9. 56940 str.
10. 31680 yards

*Division.*

$$23) 107615827 (4678949$$

92

$$\begin{array}{r}
 156 \\
 138 \\
 \hline
 181 \\
 161 \\
 \hline
 205 \\
 184 \\
 \hline
 21
 \end{array}$$

1. 4678949
2. 495108
3. 342926<sup>8</sup>/<sub>10</sub>
4. 78460839
5. 80987541<sup>8</sup>/<sub>10</sub>
6. 91468937
7. 78460839
8. 858850<sup>18</sup>/<sub>10</sub>
9. 91468937
10. 39232448<sup>2</sup>/<sub>5</sub>
11. 91468937
12. 91468937
13. 7639738<sup>8</sup>/<sub>10</sub>
14. 6801816<sup>16</sup>/<sub>10</sub>
15. 91468379504
16. 6789456
17. 80455464<sup>220</sup>/<sub>10</sub>
18. 247567
19. 317649
20. 2706915
21. 147678
22. 7358
23. 1711<sup>3055</sup>/<sub>10</sub>
24. 1786<sup>913</sup>/<sub>10</sub>
25. 899<sup>75424</sup>/<sub>10</sub>
26. 764258
27. 5648736
28. 144171<sup>62</sup>/<sub>10</sub>
29. 12076849
30. 1460900
31. 2768000
32. 4050010<sup>8596837</sup>/<sub>10</sub>
33. 207008009

$$\begin{array}{r}
 48 \left\{ \begin{array}{l} 8) 85536 \\ 6) 10692 \end{array} \right. \\
 \hline
 1782
 \end{array}$$

1. 1782
2. 2074<sup>1</sup>/<sub>2</sub>
3. 198<sup>5</sup>/<sub>8</sub>
4. 17691<sup>1</sup>/<sub>4</sub>
5. 457<sup>7</sup>/<sub>8</sub>



6. 10313 $\frac{1}{2}$
7. 78504
8. 907356
9. 3891468
10. 7553344
11. 784689
12. 63425
1. 445 $\frac{1}{2}$
2. 95 sheets
3. 111 trees in each
4. 15 $\frac{1}{2}$
5. 67 $\frac{1}{2}$
6. 20 feet
7. 521
8. 8465

*Reduction \*.*

1. 18712
2. 75156 g. 4s
3. 63519 j. 26s
4. 3557082 m. 7s 6d
5. 416896 j. 24s
6. 9441018180 f.
7. 98761653 $\frac{1}{2}$
8. 1306247 h. g. 2s 6d
9. 104400000d
10. 63000 groats
11. 359 half-crown 2s 2d
12. 12797 g. 3s
13. 807735 g. 15s
14. 70177449 mar.
15. 544929486 j. 4s
16. 1579338 nob.
17. 861584 q. g. 4s
18. 5747881 lb. g. 9s 6d
19. 19965 cr. 1s 8d
20. 16960 of each
21. 50004 nob. 54d

22. 348572 m.
23. 21519 mar. 5s
24. 670 nob. 6s 4d
25. 3456 of each

*Weights and Measures.*

1. 573440 dr.
2. 32625341 dr.
3. 975629 dr.
4. 1568 ounce
5. 6922 dr.
6. 501775 ounce
7. 18832 ton 16 cwt 2 qrs  
18 lb. 13 ounce
8. 31 cwt 3 qrs 16 lb. 15  
ounce 2 dr.
9. 31 cwt 1 qr 3 lb. 1 ounce
10. 220 qr. 25 lb. 8 oz.
11. 1869 lb. 14 oz. 10 dr.
12. 2552 ton 6cwt 15 lb. 12 oz.
13. 5760 gr.
14. 2793551 gr.
15. 5610552 gr.
16. 5301 gr.
17. 92 ounce
18. 86472 gr.
19. 192 lb.
20. 13 lb. 8 oz. 10 dwt 8 gr.
21. 854 lb. 6 dwt 3 gr.
22. 1015 oz. 12 dwt 8 gr.
23. 6243072 lb. 10 ounce
24. 6800 lb. 1 oz. 12 dwt
25. 5760 gr.
26. 3968657 gr.
27. 225888 scruples
28. 2730 lb. 10 oz. 5 dr. 1 scr.
29. 649 lb. 7 ounce 5 dr. 1  
scruple 15 grains

\* The twelve first examples are descending; that is, proceed from a greater name to a less, and are reversed by the next twelve, which are ascending.

- |  |   |
|--|---|
| 30. 95279 lb. 11 oz. 2 dr.               | 72. 13194 kild.                         |
| 31. 119804 nails                         | 73. 6784 hhds                           |
| 32. 1764378 inches                       | 74. 18617 hhds 30 gallons               |
| 33. 150 h. n.                            | 75. 50182 gallons                       |
| 34. 49042 yards 2 qrs                    | 76. 3136 qr. 3 pecks                    |
| 35. 49010 $\frac{1}{2}$ yards            | 77. 2449407 pints                       |
| 36. 1177109 qr 1 n.                      | 78. 1715 qrs 6 bush. 4 pints            |
| 37. 98083 yds 3 qrs                      | 79. 62204459 seconds                    |
| 38. 44925 ells English                   | 80. 8766 hours                          |
| 39. 59763 yards                          | 81. 1893416220 thirds                   |
| 40. 731708 ells English                  | 82. 31557600 seconds                    |
| 41. 17537898 ells Fl.                    | 83. 6 y. 1 d. 10 h. 53 m. 45 f. 54 t.   |
| 42. 4979636 ells Fr. 4 qrs               | 84. 56449440000 seconds                 |
| 43. 570240 b. c.                         |   |
| 44. 138893005672960 yds                  | <i>Compound Addition.</i>               |
| 45. 2233461 b. c.                        | 1. 6ol 8s 9d                            |
| 46. 251982 m. 940 y. 1 in. 1 b. c.       | 2. 58l 19s 9 $\frac{1}{2}$ d            |
| 47. 14945954 l. 1 m. 34 yds              | 3. 715l 10s 0d                          |
| 48. 487294 m. 580 yds 2 f.               | 4. 3997l 8s 11d                         |
| 49. 748480 poles                         | 5. 66807l 9s 8d                         |
| 50. 92577 poles                          | 6. 55862l 0s 4d                         |
| 51. 3794802 yards                        | 7. 50650l 6s 5 $\frac{1}{2}$ d          |
| 52. 76618 f.                             | 8. 99153l 10s 2 $\frac{1}{2}$ d         |
| 53. 2993530 acres                        | 9. 309987l 9s 0 $\frac{1}{2}$ d         |
| 54. 24686723 r. 26 poles                 | 10. 1243954l 19s 2d                     |
| 55. 4028238 r. 17 p. 3 $\frac{1}{2}$ yds | 11. 283 ton 8 cwt 1 qr                  |
| 56. 849213 ac. 28 f. 8 ells              | 12. 117 lb. 7 oz. 5 dr.                 |
| 57. 381024 inches                        | 13. 192 c. 3 q. 17 lb. 12 oz. 5 dr.     |
| 58. 252 yards                            | 14. 293 lb. 5 oz. 7 dwt 4 gr.           |
| 59. 49312                                | 15. 105 lb. 6 oz. 5 dwt 13 gr.          |
| 60. 684 foot 128 inches                  | 16. 49 lb. 7 dr. 2 scr.                 |
| 61. 11337408                             | 17. 55 yds 2 qrs 2 nails                |
| 62. 297 yards                            | 18. 43 l. 2 m. 1 f. 10 poles            |
| 63. 246691349 pun. 52 gal.               | 19. 118 p. 3 yds 2 ft 10 in.            |
| 64. 180930 bar. 21 g.                    | 20. 120 acres 9 poles                   |
| 65. 7571328 hhds                         | 21. 48 ac. 29 p. 10 $\frac{1}{2}$ yards |
| 66. 74860 runlets                        | 22. 80 qrs 4 bushels 3 pecks            |
| 67. 5242 hds 36 gal.                     | 23. 32 ton 1 hhd 42 g. 6 pts w.         |
| 68. 1266336 pints                        | 24. 38 hhds 14 g. 1 pint beer           |
| 69. 6030 hhds beer 12 gal.               | 25. 37 hhds 40 gal. 1 qt ale            |
| 70. 2304 pints                           | 26. 721 days 5 h. 42 minutes            |
| 71. 7452 barrels                         | 27. 82 sto. 10 lb. 11 oz. 12 dr.        |

- |                              |                                      |
|------------------------------|--------------------------------------|
| 28. 38 ac. 3 r. 34 f. 4 ells | 37. 966l 2s 5d                       |
| 29. 46 chal. 7 bolls         | 38. 3223l 18s 11d                    |
| 30. 35 g. 4 pts 1 mutchkin   | 39. 8884l 1s 7d                      |
| 31. 4270l 1s                 | 40. 11169 c. 1 q. 14 lb. 1 oz. 14 d. |
| 32. 3516l 12s 11d            | 41. 1750l 4s 3d                      |
| 33. 2862 yds 1 qr 1 nail     | 42. 77 lb. 8 dwt 18 gr.              |
| 34. 12l 6s 5½d               | 43. 372i acr. 2 rood 10 poles        |
| 35. 3296l 18s 8½d            | 44. 200 m. 5 f. 34 p. 5 yards        |
| 36. 764l 9s                  | total distance.                      |

## Compound Subtraction.

1. 6478l 13s 8½d — 517l 19s 4½ = 5960l 14s 3¼d
2. 1462 5 0 — 644 7 6 = 817 17 6
3. 7338 6 2½ — 4143 4 9½ = 3195 1 5
4. 2988 7 7 — 1232 10 4 = 1755 17 3
5. 89 lb. 7 oz. 3 d. 3 g. — 89 lb. 5 oz. 19 d. 15 g. = 1 oz. 3 d. 12
6. 32 lb. — 29 lb. 6 oz. 4 dwt 21 gr. = 2 lb. 5 oz. 15 dwt 3 gr.
7. 14 cwt 2 qrs 20 lb. — 11 18 9 2 = 3 c. 1 q. 11 lb. 6 oz. 14
8. 1272 7 1½ — 838 8 3 = 433 18 10½
9. 3465 ac. — 3199 acres 1 rood = 265 acres 3 roods
10. 347 hhds 41 g. — 240 hhds 38 g. = 107 hhds 3 gallons
11. 197 hhds 17 g. — 116 hhds 16 g. 4 pts = 81 hhds 4 pts
12. 4122 19 6 — 445 0 0 = 3677 19 6
13. 5462 2 0 — 2022 4 5 = 3439 17 7
14. 58 cwt 1 qr 27 lb — 6 cwt 2 lb. = 52 lb. 1 qr 25 lb.
15. 257 cwt 25 lb. — 8 cwt 3 qrs 15 lb. = 248 c. 1 q. 10 lb.

## Compound Multiplication.

- |                  |               |               |
|------------------|---------------|---------------|
| 11. 12l 19s 10½d | 7. 132 16 0½  | 13. 840 11 6  |
| 2. 37 13 5       | 8. — 4 4½     | 14. 803 7 4   |
| 3. 449 13 9      | 9. 60 2 6     | 15. 9 16 8    |
| 4. 6 1 2½        | 10. 87 0 3½   | 16. 491 17 0  |
| 5. 144 7 4       | 11. 3 7 4½    | 17. 812 15 0½ |
| 6. 159 15 2½     | 12. 198 3 10½ | 18. 695 8 0   |

- |                              |                            |
|------------------------------|----------------------------|
| 1. 68 cwt 3 qrs 22 lb.       | 7. 79 lb. 8 oz. 9 dwt 6 gr |
| 2. 174 lb. 2 oz. 7 dr.       | 8. 381 m. 9 p. 4½ yard     |
| 3. 219 lb. 8 oz. 9 dwt 12 g. | 9. 393 hhds 41 gallons     |
| 4. 899 lb. 8 oz. 4 dr.       | 10. 23 bush. 1 p. 6 pts    |
| 5. 151 ton 2 cwt             | 11. 599 hhds 40 gallons    |
| 6. 79 lb. 1 oz. 15 dr.       | 12. 31 y. 5 m. 21 days     |

## SIMPLE PROPORTION.

25. 7 hhd's 31 gal. 3 pts wine 28. 17 m. 3 f. 14 poles  
 26. 21 lb 3 oz. 15 dwt 21 gr. 29. 5 acres 3 roods 7 poles  
 27. 17 yds 2 ft 11 in. 2 b. c.

*Practical Questions.*

1. ol 7s 8½ 11 4. 0 19 4½ 7. 125 9 0  
 2. 0 7 8½ 5. 7 cwt 2 qrs 18 lb. 8. 3s 4d a w. share  
 3. 0 14 8½ 6. 123 6 8 10s a man's do.

*Exercises.*

1. 182 8s 194 8 0 11. 110 hhd's  
 2. 2252l 18s 6d 86 8 0 12. 240 canisters  
 3. 4308 guin. 7 sh. 193 1 0 13. 1416430800 el.  
 4. 449202 dollars 264 12 0 14. 4755801600 b. c.  
 5. 701111½ yds 51 1 3 15. 1295827038 b. c.  
 6. 2937 p. 5s 6d 23200 0 0 16. 66 of each  
 7. 6175 dollars 9. 23989 10 3 17. 232 qrs 2 b. 2 p.  
 8. 12250 florins 10. 83 lb. 1 oz 2 d. 18. 88 days  
 19. 137280 times 27. 24 cwt 1 qr 21 lb.  
 20. 6911136 letters 28. 172 cwt nett  
 69 cwt 3 qrs 20 lb. gross 29. 309 cwt 17 lb. 13 ounce  
 4 0 14 tare 30. 32 cwt 3 qrs 25 lb. 12 ozs  
 21. 65 3 6 nett 31. 14s 6½d per yard  
 22. 10s 5½d a child's share 32. 4 4½ ½ per yard  
 196 143536 saturn 33. 3 11 gain  
 23. 3978 816722 mars 34. 6 11 1 per annum  
 1 1 cwt 1 qr 17 lb. 35. 11 8 1½ per annum  
 5 lb. 4 oz. 16 dwt 36. 11 1 0 gained  
 2 2 2 1 7 4½ spends per week  
 4 7 8 37. 574 12 6  
 3 11 6 38. 87 3 9  
 25. 16 1 12 39. 59635 6 0  
 26. 3 cwt 1 qr 26 lb.

*Simple Proportion.*

1. 17 y : 85s :: 307 :  $\frac{307 \times 85}{17} = \frac{26095}{17} = 1535s = 76l 14s$   
 2. 7 y : 126d :: 99 :  $\frac{126 \times 99}{7} = 1782d = 7l 8s 6d$   
 3. 100 y. : 1300 d. :: 37 y. :  $\frac{1300 \times 37}{100} = 481 d. = 2l 1d$   
 4. 68 y. : 4318 d. :: 7 y. :  $\frac{4318 \times 7}{68} = 444 d. = 1l 17s 0½d$   
 5. 228 qrs : 171 l. :: 395 qrs :  $\frac{171 \times 395}{228} = 14l 16s 3d$

## SIMPLE PROPORTION.

105

6. 19 lb. : 95 f. :: 353 lb. :  $\frac{353 \times 95}{19} = 1765 = 88 \frac{1}{2} s$   
 7. 47 y. : 33135 f. :: 117 y. :  $\frac{33135 \times 117}{47} = 82485 = 85 \frac{1}{2} l 18 s 5 \frac{1}{2} d$   
 8. 57 y. : 53010 f. :: 152 y. :  $\frac{53010 \times 152}{57} = 141360 = 147 \frac{1}{2} s$   
 9. 41 hhds : 275643 f. :: 33 hhds :  $\frac{275643 \times 33}{41} = 221859 = 231 \frac{1}{2} l 2 s 0 \frac{1}{2} d$   
 10. 51 lb. : 18819 f. :: 2156 lb. :  $\frac{18819 \times 2156}{51} = 795564 = 828 \frac{1}{2} l 14 s 3 d$   
 11. 837900 f. : 1652 lb. :: 7125 f. :  $\frac{1652 \times 7125}{837900} = 14 \frac{1}{2} l$   
 12. 525 f. : 14 lb. :: 9450 f. :  $\frac{14 \times 9450}{525} = 252 = 2 \text{ cwt } 1 \text{ qr}$   
 13. 45180 f. 30 cwt :: 1779 f. :  $\frac{1779 \times 30}{45180} = 1 \text{ cwt } 20 \frac{7}{11} l$   
 14. 365 d. : 8929 d :: 73 d :  $\frac{8929 \times 73}{365} = 17 \frac{1}{2} l 8 s 9 \frac{1}{2} d \frac{1}{2}$   
 15. 17 y : 4798 f. :: 75 y. :  $\frac{4798 \times 75}{17} = 21167 \frac{1}{2} = 22 \frac{1}{2} l 11 \frac{1}{2} d \frac{1}{2}$   
 16. 100 qrs : 350 d. :: 285 qrs :  $\frac{350 \times 285}{100} = 997 \frac{1}{2} = 4 \frac{1}{2} l 3 s 1 \frac{1}{2} d$   
 17. 84 qrs : 172 f. :: 38 qrs :  $\frac{172 \times 38}{84} = 78 \frac{1}{3} = 3 \frac{1}{3} l 17 s 9 \frac{1}{3} d \frac{2}{3}$   
 18. 141 qrs : 4856 d :: 1224 qrs :  $\frac{4856 \times 1224}{141} = 175 \frac{1}{2} l 12 s 10 \frac{1}{2} d$   
 19. 4 qrs : 23 f. :: 354 qrs :  $\frac{23 \times 354}{4} = 2035 \frac{1}{2} = 2 \frac{1}{2} l 2 s 4 \frac{1}{2} d \frac{1}{2}$   
 20. 18 lb : 738 f. :: 6370 lb :  $\frac{738 \times 6370}{18} = 261170 = 272 \frac{1}{2} l 1 s \frac{1}{2} d$   
 21. 54 g. : 1039 d :: 3031 g :  $\frac{1039 \times 3031}{54} = 242 \frac{1}{2} l 19 s 10 \frac{1}{2} d \frac{1}{2}$   
 22. 160 p : 6450 d :: 33135 p. :  $\frac{6450 \times 33135}{160} = 5565 \frac{1}{2} l 12 s 10 \frac{1}{2} d \frac{1}{2}$   
 23. 256 p. : 1762 f. :: 24553 p. :  $\frac{1762 \times 24553}{256} = 176 \frac{1}{2} l 5 s 0 \frac{1}{2} d \frac{1}{2}$   
 24. 84 g. : 756 f. :: 17 g. :  $\frac{756 \times 17}{84} = 153 \frac{1}{2} = 1 \frac{1}{2} l 13 s$   
 25. 1440 dwt : 378 f. :: 6825 dwt :  $\frac{378 \times 6825}{1440} = 89 \frac{1}{2} l 11 s 6 \frac{1}{2} d$   
 26. 49 g. : 990 d. :: 574 g. :  $\frac{990 \times 574}{49} = 48 \frac{1}{2} l 6 s 5 \frac{1}{2} d$   
 27. 11 lb. : 210 f. :: 886 lb. :  $\frac{210 \times 886}{11} = 17 \frac{1}{2} l 12 s 4 \frac{1}{2} d \frac{1}{2}$   
 28. 7 lb. : 3234 f. :: 1707 lb. :  $\frac{3234 \times 1707}{7} = 821 \frac{1}{2} l 9 s 10 \frac{1}{2} d$   
 29. 17 lb. : 85 d. :: 352 :  $\frac{85 \times 352}{17} = 7 \frac{1}{2} l 6 s 8 d$   
 30. 28 ft. : 13307 far. :: 6384 ft. :  $\frac{13307 \times 6384}{28} = 3160 \frac{1}{2} l 8 s 3 d$   
 31. 72 m. : 108 d. :: 42 m. : 63 days  
 32. 9 d : 18 m. :: 4 d. : 8 men  
 33. 37 m. : 156 d. :: 57 m. :  $240 \frac{1}{2} \frac{2}{3}$  days  
 34. 9 d. : 28 p. :: 36 d. : 112 persons  
 35. 45 d. : 54 oz. :: 48 d. : 4 lb. 9 oz. 12 dwt  
 36. 648 dwt : 54 d. :: 720 dwt : 5 s  
 37. 8 m. : 2000 men :: 6 m. : 1500 men  
 38. 1925 l : 9 m. :: 275 l : 1 m. 1 w. 1 day  
 39. 3575 : 18150 s :: 39 : 198 s = 9 l 18 s  
 40. 58 oz. : 5974 d. :: 12 oz. : 1236 d. = 5 l 3 s  
 41. 4 : 1158 d. :: 105 : 126 l 13 s 1 d  
 42. 25 f. : 3 lb. :: 34 f. : 4 lb. 19 dwt 4 s gr.  
 43. 1 l 17 s 6 d    44. 2689 l 17 s    45. 2700 men    46. 739 l  
 47. 400 men    48. 30 yards    49. 55 l 10 s    50. 10 s 6 d

25. 7 hhds 31 gal. 3 pts wine 28. 17 m. 3 f. 14 poles  
 26. 21 lb 3 oz. 15 dwt 21 gr. 29. 5 acres 3 roods 7 poles  
 27. 17 yds 2 ft 11 in. 2 b. c.

*Practical Questions.*

1. ol 7s 8½ 11 4. 0 19 4½ 7. 125 9 0  
 2. 0 7 8½ 5. 7 cwt 2 qrs 18 lb. 8. 3s 4d a w. share  
 3. 0 14 8½ 6. 123 6 8 10s a man's do.

*Exercises.*

1. 182 8s 194 8 0 11. 110 hhds  
 2. 2252l 18s 6d 86 8 0 12. 240 canisters  
 3. 4308 guin. 7 sh. 193 1 0 13. 1416430800 cl.  
 4. 449202 dollars 264 12 0 14. 4755801600 b.c.  
 5. 701111½ yds 51 1 3 15. 1295827038 b.c.  
 6. 2937 p. 5s 6d 23200 0 0 16. 66 of each  
 7. 6175 dollars 9. 23989 10 3 17. 232 qrs 2 b. 2 p.  
 8. 12250 florins 10. 83 lb. 1 oz 2 d. 18. 88 days  
 19. 137280 times 27. 24 cwt 1 qr 21 lb.  
 20. 6911136 letters 28. 172 cwt nett  
 69 cwt 3 qrs 20 lb. gross 29. 309 cwt 17 lb. 13 ounce  
 4 0 14 tare 30. 32 cwt 3 qrs 25 lb. 12 oz  
 21. 65 3 6 nett 31. 14s 6½d per yard  
 22. 10s 5½d a child's share 32. 4 4½ ½ per yard  
 196 ¼ ½ ¾ ¾ fatur 33. 3 11 gain  
 23. 3978 8 2 6 7 2 2 mars 34. 6 11 1 per annum  
 1978361 35. 11 8 1½ per annum  
 24. 1 cwt 1 qr 17 lb. 36. 11 1 0 gained  
 5 lb. 4 oz 16 dwt 1 7 4 ½ spends per week  
 2 2 2 37. 574 12 6  
 4 7 8 38. 87 3 9  
 3 11 6 39. 59635 6 0  
 25. 16 1 12  
 26. 3 cwt 1 qr 26 lb.

*Simple Proportion.*

1. 17 y : 85s :: 307 :  $\frac{307 \times 85}{17} = \frac{26095}{17} = 1535s = 76l 14s 5d$   
 2. 7 y : 126d :: 99 :  $\frac{126 \times 99}{7} = 1782d = 7l 8s 6d$   
 3. 100 y. : 1300 d. :: 37 y. :  $\frac{1300 \times 37}{100} = 481 d. = 2l 1d$   
 4. 68 y. : 4318 d. :: 7 y. :  $\frac{4318 \times 7}{68} = 444 d. = 1l 17s 0½d$   
 5. 228 qrs : 171 f. :: 395 qrs :  $\frac{171 \times 395}{228} = 14l 16s 3d$

## SIMPLE PROPORTION.

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6. 19 lb. : 95 f. :: 353 lb. :  $33535 = 1765 = 88\frac{1}{2}f$   
 7. 47 y. : 33135 f. :: 117 y. :  $3876795 = 82485 = 85\frac{1}{2}l 18s 5\frac{1}{2}d$   
 8. 57 y. : 53010 f. :: 152 y. :  $8017520 = 141360 = 147\frac{1}{2}ls$   
 9. 41 hhds : 275643 f. :: 33 hhds :  $9096219 = 221859 = 231\frac{1}{2}l 2s 0\frac{1}{2}d$   
 10. 51 lb. : 18819 f. :: 2156 lb. :  $40573764 = 795564 = 828\frac{1}{2}l 14s 3d$   
 11. 837900 f. : 1652 lb. :: 7125 f. :  $420375 = 14\frac{1}{4}l$   
 12. 525 f. : 14 lb. :: 9450 f. :  $132300 = 252 = 2 \text{ cwt } 1 \text{ qr}$   
 13. 45180 f. 30 cwt :: 1779 f. :  $53370 = 1 \text{ cwt } 20\frac{7}{8}l$   
 14. 365 d. : 8929 d. :: 73 d. :  $651817 = 7\frac{1}{2}l 8s 9\frac{1}{2}d \frac{1}{2}$   
 15. 17 y. : 4798 f. :: 75 y. :  $359830 = 21167\frac{1}{4} = 22\frac{1}{2}l 11\frac{1}{2}d \frac{1}{4}$   
 16. 100 qrs : 350 d. :: 285 qrs :  $99750 = 4\frac{1}{2}l 3s 1\frac{1}{2}d$   
 17. 84 qrs : 172 f. :: 38 qrs :  $6536 = 3\frac{1}{2}l 17s 5\frac{1}{2}d \frac{6}{7}$   
 18. 141 qrs : 4856 d. :: 1224 qrs :  $5943744 = 175\frac{1}{2}l 12s 10\frac{1}{4}d \frac{1}{2}$   
 19. 4 qrs : 23 f. :: 354 qrs :  $8142 = 203\frac{1}{2} = 2\frac{1}{2}l 2s 4\frac{1}{2}d \frac{1}{2}$   
 20. 18 lb : 738 f. :: 6370 lb :  $4701060 = 261170 = 272\frac{1}{2}l 1s \frac{1}{2}d$   
 21. 54 g. : 1039 d. :: 3031 g. :  $3149209 = 242\frac{1}{2}l 19s 10\frac{1}{2}d \frac{2}{9}$   
 22. 160 p : 6450 d. :: 33135 p. :  $213720750 = 5565\frac{1}{2}l 12s 10\frac{1}{2}d \frac{1}{2}$   
 23. 256 p. : 1762 f. :: 24583 p. :  $43315246 = 176\frac{1}{2}l 5s 0\frac{1}{2}d \frac{1}{4}$   
 24. 84 g. : 756 f. :: 17 g. :  $12852 = 153\frac{1}{2}f. = 1\frac{1}{2}l 13s$   
 25. 1440 dwt : 378 f. :: 6825 dwt :  $2579850 = 89\frac{1}{2}l 11s 6\frac{1}{2}d$   
 26. 49 g. : 990 d. :: 574 g. :  $568260 = 48\frac{1}{2}l 6s 5\frac{1}{2}d$   
 27. 11 lb. : 210 f. :: 886 lb. :  $286060 = 17\frac{1}{2}l 12s 4\frac{1}{2}d \frac{5}{11}$   
 28. 7 lb. : 3234 f. :: 1707 lb. :  $5520438 = 821\frac{1}{2}l 9s 10\frac{1}{2}d$   
 29. 17 lb. : 85 d. :: 352 :  $29920 = 7\frac{1}{2}l 6s 8d$   
 30. 28 ft. : 13307 far. :: 6384 ft. :  $3033996 f. = 3160\frac{1}{2}l 8s 3d$   
 31. 72 m. : 108 d. :: 42 m. : 63 days  
 32. 9 d : 18 m. :: 4 d. : 8 men  
 33. 37 m. : 156 d. :: 57 m. :  $240\frac{1}{4} \text{ days}$   
 34. 9 d. : 28 p. :: 36 d. : 112 persons  
 35. 45 d. : 54 oz. :: 48 d. : 4 lb. 9 oz. 12 dwt  
 36. 648 dwt : 54 d. :: 720 dwt : 5s  
 37. 8 m. : 2000 men :: 6 m. : 1500 men  
 38. 1925 l : 9 m. :: 275 l : 1 m. 1 w. 1 day  
 39. 3575 : 18150s :: 39 : 198s = 9 l 18s  
 40. 58 oz. : 5974 d. :: 12 oz. : 1236 d. = 5 l 3s  
 41. 4 : 1158 d. :: 105 : 126 l 13s 1 d  
 42. 25 f. : 3 lb. :: 34 f. : 4 lb. 19 dwt 4 gr.  
 43. 1 l 17s 6d    44. 2689 l 17s    45. 2700 men    46. 735 l  
 47. 400 men    48. 30 yards    49. 55 l 10s    50. 10s 6d

51. 13 oz. 6 dwt 16 gr.    52. 9 m. 18 days.    53. 87<sup>l</sup> 10s  
 54. 6<sup>l</sup> 8s 5<sup>1</sup>/<sub>2</sub>d <sup>1</sup>/<sub>4</sub>    55. 26<sup>l</sup>    56. 10s 2<sup>1</sup>/<sub>2</sub>d <sup>1</sup>/<sub>4</sub>    57. 9<sup>l</sup> 7s 6d  
 58. 425<sup>l</sup> pr : 4845 d. int. :: 100<sup>l</sup> pr : 4<sup>l</sup> 15s  
 59. 200 fixp. : 100<sup>l</sup> :: 2571 fixp. : 1285<sup>l</sup> 10s  
 60. 6 m. : 125<sup>l</sup> :: 8 m. : 166<sup>l</sup> 13s 4d  
 61. 432 ft : 342 f. :: 660 ft : 26<sup>l</sup> 2s 6d  
 62. 30 threep. : 81 yds :: 21 threep. : 56 y. 2 qrs 3<sup>1</sup>/<sub>2</sub> nails  
 63. 369 f. : 1 yd :: 18819 f. : 51 yds  
 64. 78 m. : 678 qrs :: 130 m. : 1130 qrs = 282 cwt 2 qrs  
 65. 128 yds. : 32 d. :: 64 yd : 1s 4d  
 66. 210 cwt : 12c m. :: 60 cwt : 34<sup>1</sup>/<sub>2</sub> miles  
 67. 15 fixp. : 9s :: 5 fixp. : 3s  
 68. 15 fixp. : 756 yds :: 10 : 504 yds  
 69. 3 qrs : 90 yds : 5 : 150 yards  
 70. 9 fixp. : 84 yds :: 15 fixp. : 140 yards  
 71. 5 sec. : 36 yds :: 3600 sec. : 25920 yds  
 72. (378 g.—42g.) 336 g. : 3213 f. :: 84 gal. : 40s 3s 3d  
 73. 24 y. : 36 f. :: 141 y. :  $\frac{36 \times 141}{24} = \frac{3 \times 141}{2} = \frac{423}{2} = 10<sup>l</sup> 11s 6d$

*Compound Proportion.*

1. 12 : 100 : 5 :: 1650 : 42 :  $\frac{5 \times 1650 \times 42}{12 \times 100} = \frac{1155}{4} = 288<sup>l</sup> 15s$
2. 365 d. 100<sup>l</sup> pr. : 5<sup>l</sup> int. :: 675<sup>l</sup> pr. : 438 d. : 40<sup>l</sup> 10s  
 3. 15 m. : 27 d. : 37 r. :: 63 d. : 74 m. : 425<sup>1</sup>/<sub>2</sub><sup>l</sup> roods  
 4. 15 d. : 84 m. : 72 ac. :: 96 m. : 12 d. : 65 ac. 3 r. 12<sup>1</sup>/<sub>4</sub> p.  
 5. 18 m. : 600<sup>l</sup> : 45<sup>l</sup> :: 100<sup>l</sup> : 12 m. : 5<sup>l</sup>  
 6. 365 d. : 100<sup>l</sup> : 5<sup>l</sup> :: 650<sup>l</sup> : 173 d. : 15<sup>l</sup> 8s 1<sup>1</sup>/<sub>2</sub>d <sup>1</sup>/<sub>4</sub>  
 7. 52 w. : 100<sup>l</sup> : 5<sup>l</sup> :: 375<sup>l</sup> : 37 w. : 13<sup>l</sup> 6s 9<sup>1</sup>/<sub>2</sub>d <sup>1</sup>/<sub>4</sub>  
 8. 39 w. : 175<sup>l</sup> : 5670 f. :: 100<sup>l</sup> : 52 w. : 4<sup>1</sup>/<sub>2</sub><sup>l</sup> per cent.  
 9. 146 d. : 200<sup>l</sup> : 56s :: 100<sup>l</sup> : 365 d. : 3<sup>1</sup>/<sub>2</sub><sup>l</sup> per cent.  
 10. 5 y. : 150 fixp. : 100<sup>l</sup> :: 352 fixp. : 1 y. : 47<sup>l</sup> principal.  
 11. 975<sup>l</sup> : 1040 d. : 1 y. :: 45630 d. : 100<sup>l</sup> : 4<sup>1</sup>/<sub>2</sub> years  
 12. 108 d. : 236 m. : 160 qrs :: 76 m. 432 d. : 206<sup>1</sup>/<sub>2</sub><sup>l</sup> qrs.  
 13. 8 h. : 12 d. : 360 m. :: 60 d. : 6 h. : 1350 miles  
 14. 30 m. : 8 h. : 36 d. :: 12 h. 24 m. : 43<sup>1</sup>/<sub>2</sub> days.  
 15. 435 thr. : 90 cwt : 15 m. :: 30 cwt : 2320 th. 26 m. 5<sup>1</sup>/<sub>2</sub> f.  
 16. 9 d. : 9 oz. : 10 f. :: 36 oz. : 1 d. : 4s 5<sup>1</sup>/<sub>2</sub>d <sup>1</sup>/<sub>4</sub>  
 17. 3 in. : 16 in. : 12 in. :: 12 in. : 12 : 36 inches  
 18. : 18s : 3d : 18 m. : 16s :: 45 m. : 27d : 15s : 15d



# COMPOUND PROPORTION.

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19. 6 h.: 30 yds: 12 m.: 12 d.: 8 m.: 60 yds: 8 h.: 21 $\frac{1}{2}$  days  
20. 12: 24 d.: 12: 12: 3: 60 :: 4: 20: 18: 18: 8: 100 ft

## Practice, Rule 1st,

1. 77 19 6	16. 6180 13 4	31. 164 8 1
2. 187 7 8 $\frac{1}{2}$	17. 39 7 2	32. 7486 8 0
3. 309 18 2	18. 70 6 2	33. 728 18 0
4. 467 18 10 $\frac{1}{2}$	19. 40 18 8	34. 9335 17 6
5. 730 9 4	20. 182 19 6	35. 2615 6 8
6. 9820 18 6	21. 699 11 4	36. 15244 13 4
7. 812 8 8	22. 2292 3 6	37. 6247 0 0
8. 2175 1 6	23. 445 18 6	38. 1493 12 0
9. 24937 0 0	24. 4958 0 0	39. 45733 10 0
10. 26189 0 0	25. 2447 16 8	40. 622 7 10
11. 3668 10 0	26. 1640 11 8	41. 521 1 9
12. 2743 0 0	27. 1173 10 0	42. 619 2 0
13. 11458 0 0	28. 15749 16 0	43. 593 14 0
14. 9362 0 0	29. 4729 0 0	44. 18329 12 0
15. 7844 12 0	30. 12494 0 0	

## Rule 2d,

4 8 4 6 9	10. 16677 12 0	30. 99148 0 0
5	11. 6607 16 0	31. 10970 8 0
12)2 4 2 3.4 5	12. 53280 14 0	32. 31995 12 0
2.0)20195 5	13. 50804 8 0	33. 44435 14 0
1009155	14. 4853 11 0	34. 13666 8 0
or,	15. 1027 12 0	35. 3936 3 4
4d= $\frac{1}{2}$ 4 8 4 6 9	16. 5886 15 0	36. 54878 8 0
1= $\frac{1}{2}$ 1 6 1 5 6 4	17. 5971 4 0	37. 26941 4 0
4 0 3 9 1	18. 1336 10 0	38. 47488 14 0
2.0)20195 5	19. 70949 16 0	39. 28111 10 0
1. 1009 15 5	20. 3204 0 0	40. 75789 8 0
2. 2178 6 3	21. 34237 0 0	41. 73474 4 0
3. 3224 18 8	22. 95469 0 0	42. 65571 4 0
4. 1865 11 0	23. 1924 0 0	
5. 1734 15 0	24. 41 10 1	
6. 343 0 4	25. 330568 0 0	
7. 12701 14 0	26. 1622 17 4	
8. 12506 2 0	27. 3691 13 0	
9. 5213 12 0	28. 1489 6 8	
	29. 2894 5 8	

## Rule 3d,

1. 273 8 5 $\frac{1}{2}$
2. 151 18 0 $\frac{1}{2}$
3. 127 11 11 $\frac{1}{2}$
4. 139 16 9
5. 310 15 0

6. 683 13 0
7. 568 6 4
8. 306 0 4
9. 1457 15 0
10. 298 16 2 $\frac{1}{2}$
11. 632 15 6
12. 1335 17 2
13. 1244 2 4 $\frac{1}{2}$
14. 651 13 7 $\frac{1}{2}$
15. 1049 2 2 $\frac{1}{2}$
16. 1944 19 5 $\frac{1}{2}$
17. 2622 11 9
18. 2633 17 0
19. 510 4 4 $\frac{1}{2}$
20. 1055 12 6
21. 2181 12 6
22. 1673 12 3 $\frac{1}{2}$
23. 574 15 6 $\frac{1}{2}$
24. 3550 1 10 $\frac{1}{2}$
25. 542 18 8 $\frac{1}{2}$
26. 1115 4 5
27. 2289 2 9
28. 605 1 10
29. 309 18 6
30. 1903 16 6
31. 688 9 0 $\frac{1}{2}$
32. 1407 10 1
33. 2157 3 0 $\frac{1}{2}$
34. 4566 7 10
35. 220 0 0
36. 2912 10 6
37. 458 5 0
38. 435 8 0
39. 13804 14 2 $\frac{1}{2}$
40. 17370 14 9
41. 57780 15 9
42. 12230 15 3 $\frac{1}{2}$
43. 6947 16 10 $\frac{1}{2}$
44. 8191 10 8
45. 17866 0 4
46. 4934 6 9 $\frac{1}{2}$

47. 30524 2 8
48. 16065 6 8
49. 9463 9 8 $\frac{1}{2}$
50. 7345 1 0
51. 6014 18 4
52. 4526 18 9 $\frac{1}{2}$
53. 238286 13 4
54. 161952200
55. 909506 6 0
56. 36373 4 0
57. 33391 6 6
58. 306814 8 0
59. 139089 10 0
60. 28316 18 8

Rule 4.

$$29. = \frac{1}{2} 31 18 6d$$

6x3

$$\begin{array}{r} 23 \ 11 \ 0 \\ \hline \end{array}$$

$$70 \ 13 \ 0$$

$$19. = \frac{1}{2} 1 \ 19 \ 3$$

$$41b. = \frac{1}{2} 0 \ 19 \ 7\frac{1}{2}$$

$$\begin{array}{r} 0 \ 2 \ 9\frac{1}{2} \\ \hline \end{array}$$

$$1. \ 731 \ 14 \ 8d$$

$$2. \ 101 \ 6 \ 7$$

$$3. \ 43 \ 6 \ 6$$

$$4. \ 72 \ 19 \ 9\frac{1}{2}$$

$$5. \ 19 \ 8 \ 10$$

$$6. \ 6 \ 18 \ 5\frac{1}{2}$$

$$7. \ 282 \ 2 \ 1\frac{1}{2}$$

$$8. \ 164 \ 4 \ 4$$

$$9. \ 38 \ 14 \ 1\frac{1}{2}$$

$$10. \ 3633 \ 13 \ 9\frac{1}{2}$$

$$11. \ 1 \ 0 \ 9\frac{1}{2}$$

$$12. \ 0 \ 9 \ 11$$

$$13. \ 2083 \ 15 \ 10$$

$$14. \ 2420 \ 10 \ 8\frac{1}{2}$$

$$15. \ 19 \ 19 \ 2\frac{1}{2}$$

$$16. \ 19 \ 19 \ 2\frac{1}{2}$$

$$17. \ 7 \ 12 \ 6$$

$$18. \ 76 \ 13 \ 8\frac{1}{2}$$

19. 19 2 8
20. 223 7 7 $\frac{1}{2}$
21. 414 6 0
22. 196 14 9 $\frac{1}{2}$
23. 160 10 2
24. 219 15 6
25. 1216 15 4
26. 379 7 0 $\frac{1}{2}$
27. 12 3 6 $\frac{1}{2}$
28. 15 4 5 $\frac{1}{2}$
29. 142 8 2 $\frac{1}{2}$
30. 36 6 3
31. 104 14 9
32. 46 13 9 $\frac{1}{2}$
33. 732 5 10
34. 672 19 9 $\frac{1}{2}$
35. 3043 5 10 $\frac{1}{2}$
36. 398 9 6
37. 2553 6 10 $\frac{1}{2}$
38. 892 7 10 $\frac{1}{2}$
39. 767 7 7 $\frac{1}{2}$
40. 634 7 6
41. 637 15 10 $\frac{1}{2}$
42. 8347 15 7 $\frac{1}{2}$

Exercises.

1. 575 19 1
2. 38588 4 0
3. 8310 4 7
4. 843 10 0
5. 7174 17 8
6. 38664 0 2 $\frac{1}{2}$
7. 26624 2 6
8. 4244 8 0
9. 638 3 10 $\frac{1}{2}$
10. 304 1 11 $\frac{1}{2}$
11. 5327 7 0
12. 7107 9 3
13. 2448 15 0
14. 1943 3 2 $\frac{1}{2}$
15. 126 8

16. 18 6 $1\frac{1}{2}$	16 lb. $=\frac{1}{7}$ 6786 2 gros
17. 415 15 $0\frac{1}{2}$	2 $=\frac{1}{8}$ 969 2
18. 2668 18 $9\frac{1}{4}$	121 0 21
19. 3612 11 2	1090 2 21 tare
20. 4333 14 4	26) 5695 3 7 t. fut.
21. 410 cwt 1 qr $3\frac{1}{2}$ lb.	219 8 -
22. 270 cwt 2 qrs 10 lb.	168) 5476 2 27 tr. fut.
23. 832 cwt 1 qr 11 lb.	32 2 11 cloff
24. 618 cwt 1 qr 6 lb. 8 oz.	40. 5444 0 16 net weight.
25. 273 cwt 2 qrs 23 lb. 10 oz.	16 lb. $=\frac{1}{7}$ 118 cwt 1 qr gros
26. 372 cwt 11 lb. 10 oz.	4 $=\frac{1}{4}$ 16 3.16
27. 56 cwt 3 qrs 27 lb.	4 0 25
28. 284 cwt 9 lb. 2 oz. 6 dr.	21 0 13 tare
29. 26 cwt 1 qr	26) 97 0 15 t. fut.
30. 141 cwt 3 qrs	3 2 26 trett
31. 105 cwt 3 qrs 4 lb. 9 oz. 3 dr.	168) 93 1 17 t. fut.
32. 136 cwt 8 lb. 11 oz. 3 dr.	0 2 6 cloff
33. 12 cwt 22 lb. trett	41. 92 3 11 nett wt
34. 1 cwt 12 lb.	8 $=\frac{1}{4}$ 66 0 8 gros
35. 2 cwt 3 qrs 16 lb. 14 oz.	4 $=\frac{1}{2}$ 4 2 24 9
12 dr.	2 1 12 5
36. 3 cwt 2 qrs 25 lb. 4 oz.	7 0 8 14 tare
14 dr.	26) 58 3 27 2 t. fut.
37. 2 qrs 1 lb. cloff.	2 1 2 2 trett
38. 1 qr. 8 lb. 5 oz. 5 dr.	168) 56 2 25 0 t. fut.
39. 26 lb. 5 oz. 5 dr.	0 1 9 13 cloff
	42. 56 1 15 3 nett wt.

## Bills of Parcels, &c.

(1.) 5 9 4	(2.) 2 2 9	(3.) 5 5 9	(4.) 24 1 3
4 9 10	1 3 11	6 13 2	20 14 2
10 7 $7\frac{1}{2}$	5 10 8	19 19 0	28 10 $6\frac{1}{2}$
9 11 0	3 8 0	11 12 11	7 1 10
1 18 3	2 0 6	19 18 9	2 1 $7\frac{1}{2}$
20 13 4	2 7 3	1 13 3	6 2 $3\frac{1}{2}$
£.52 9 $4\frac{1}{2}$	£.16 13 1	£.65 2 10	£.88 11 9



# A D D I T I O N.

Prob. 4.  $\frac{3}{8}$  of  $\frac{4}{11} = \frac{3}{8} \times \frac{4}{11} = \frac{3}{2} \times \frac{1}{11} = \frac{1}{2} \times \frac{1}{11} = \frac{1}{22}$ .  $\frac{1}{22}$ ,  $\frac{3}{22}$ ,  $\frac{1}{22}$ .

Prob. 5.  $7 \times 6 = 42$  } The new numerators; and  $6 \times 8 =$   
 $5 \times 8 = 40$  } the common denominator.

(2.)  $\frac{12}{819} \frac{8}{1287} \frac{18}{594} = \frac{649}{1287}$ . (3.)  $\frac{3690}{2805}, \frac{3780}{2805}, \frac{3840}{2805}, \frac{3888}{2805}$ . (4.)  
 $\frac{1144}{2805}, \frac{594}{2805}, \frac{2140}{2805}$ . (5.)  $\frac{1406}{2805}, \frac{1980}{2805}, \frac{2205}{2805}$ . (6.)  $\frac{6864}{2805}, \frac{3505}{2805}, \frac{5940}{2805}, \frac{2140}{2805}$ . (7.)  $\frac{7140}{2805}, \frac{3825}{2805}, \frac{7735}{2805}, \frac{8400}{2805}$ .  
 (8.)  $\frac{140}{1440}, \frac{800}{1440}, \frac{216}{1440}$  \*.

Prob. 6. The questions having the same number are the reverse of each other; and the examples under the note are reversed by those under Prob. 7th.

*Follows the solution of the first question of each :*

$\frac{4}{9}$  farthing reduced to the fraction of a pound  $= \frac{4}{9} \times \frac{1}{4} \times \frac{1}{12} \times \frac{1}{20} = \frac{4}{360} = \frac{1}{90}$ l, and  $\frac{1}{90}$ l reduced to the fraction of a farthing  $= \frac{1}{90} \times \frac{1}{12} \times \frac{1}{4} \times \frac{1}{20} = \frac{1}{90}$  farthing.

Next,  $\frac{4}{7}$  reduced to the fraction of a guinea  $= \frac{4}{7} \times \frac{1}{21} = \frac{1}{12}$  guinea, &c.

Lastly,  $\frac{7}{24}$  reduced to the fraction of a pound  $= \frac{7}{24} \times \frac{1}{12} \times \frac{1}{20} = \frac{7}{480}$ , &c.

# A D D I T I O N.

(1.)  $\frac{637+504+624}{728} = \frac{1765}{728} = 2\frac{309}{728}$ . (2.)  $\frac{5+6+8}{11} = \frac{19}{11} = 1\frac{8}{11}$

(3.)  $2565+6460+2907+4590 = 16527 = 1\frac{1037}{1287}$ .

(4.)  $9384+8177+11914 = 39475 = 2\frac{141}{2805}$ .

(5.)  $231+160 = \frac{391}{240}$ .

(6.)  $2574+2783+4140 = 9497 = 2\frac{389}{2805}$ .

(7.)  $45360+48384+24960+16200 = 134904 = 2\frac{1161}{2805}$ .

(8.)  $1292+2508+2431 = 6231 = 1\frac{2678}{2805}$ .

(9.)  $14364+5720 = 20084 = 1\frac{8969}{2805}$ .

(10.)  $4+7+8+1\frac{1}{2} = 20\frac{1}{2}$ .

(11.)  $9+6+8+11+\frac{7}{12} = 34\frac{7}{12}$ .

(12.)  $924+288+352+792 = 2356 = 2\frac{61}{24}$ , then  $6+14+51+2\frac{61}{24} = 73\frac{61}{24}$ .

(13.)  $77+640 = 717$ l = 8s  $1\frac{3}{4}$  d  $\frac{1}{4}$  r.

\* Compound fractions must be reduced to simple ones by Prob. 4. before they are reduced to a common denominator.

† In the examples which follow, the denominator is omitted under the numerators, but is placed under their sum.

## VULGAR FRACTIONS.

$\text{£. s. d.}$	$\text{£. s. d.}$	$\text{£. s. d.}$	$\text{£. s. d.}$
(5.) 56 20	(6.) 39 12 0	(7.) 140 00	(8.) 44 11 1
31 10	72 10 0	105 17 6	99 10 7½
15 40	128 12 6	85 6 3	63 8 5½
100 15 0	33 15 0	44 3 4	359 0 4½
17 40	19 12 0	55 19 6½	70 8 4
19 11 6	47 5 0	11 9 2	142 16 0
6 2 6	19 8 8	19 17 6	206 12 8½
<u>£. 246 00</u>	<u>£. 360 15 2</u>	<u>£. 462 13 3½</u>	<u>£. 986 7 6½</u>

(9.) 16 1 9½	(10.) 75 1 0½	(11.) 175 1 1½
25 14 8½	88 2 2	167 15 1½
42 11 8½	521 12 6	158 3 7½
14 15 11	255 1 3	197 10 7½
111 0 7½	364 19 2	237 17 1
9 9 0	307 2 11	195 12 1½
23 10 3½	180 7 6	191 0 9½
86 11 4	169 6 3	384 15 10½
<u>£. 329 15 4½</u>	<u>£. 1961 12 9½</u>	<u>£. 1707 16 5</u>

(12.) 94 8 3½	(13.) 668 10 0	(14.) 62 3 10½
20 6 3	440 4 3	30 3 9½
139 4 4½	56 13 0½	10 17 1½
215 9 3½	192 5 10	105 16 0½
60 0 11½	153 2 6	632 11 6½
143 18 9	46 11 7½	632 6 0½
238 19 0	27 15 9	47 5 8½
5 19 0	379 11 7½	257 5 0
7 12 0	20 11 10	32 10 0
40 2 1	3 2 10½	11 10 0
<u>£. 965 19 11½</u>	<u>£. 1988 9 3½</u>	<u>£. 1822 9 1</u>

*Vulgar Fractions.*

Prob. 1.  $\frac{4}{11}$ ,  $\frac{1}{10}$ ,  $\frac{523}{440}$ ,  $\frac{4332}{1715}$ ,  $\frac{140}{1715}$ ,  $\frac{191}{1710}$ ,  $\frac{161}{415}$ ,  $\frac{1}{2}$ ,  $\frac{5}{8}$ .

Prob. 2.  $4\frac{1}{8} = \frac{4 \times 8 + 3}{8} = \frac{35}{8}$

Prob. 3.  $\frac{1}{8} = 35 \div 8 = 4\frac{3}{8}$ .

# ADDITION.

111

Prob. 4.  $\frac{3}{8}$  of  $\frac{4}{15} = \frac{3}{8} \times \frac{4}{15} = \frac{1}{2} \times \frac{1}{3} = \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$ .  $\frac{1}{6}$ ,  $\frac{1}{7}$ ,  $\frac{1}{9}$  or  $\frac{1}{18}$ ,  $\frac{1}{24}$ ,  $\frac{1}{36}$ .

Prob. 5.  $7 \times 6 = 42$  } The new numerators; and  $6 \times 8 = 48$ ,  
 $5 \times 8 = 40$  } the common denominator.

(2.)  $\frac{1}{8} \times \frac{3}{4} = \frac{3}{32}$ . (3.)  $\frac{1}{8} \times \frac{3}{4} = \frac{3}{32}$ . (4.)  $\frac{1}{8} \times \frac{3}{4} = \frac{3}{32}$ .  
 $\frac{1}{8} \times \frac{3}{4} = \frac{3}{32}$ . (5.)  $\frac{1}{8} \times \frac{3}{4} = \frac{3}{32}$ . (6.)  $\frac{1}{8} \times \frac{3}{4} = \frac{3}{32}$ .  
 $\frac{1}{8} \times \frac{3}{4} = \frac{3}{32}$ . (7.)  $\frac{1}{8} \times \frac{3}{4} = \frac{3}{32}$ .  
(8.)  $\frac{1}{8} \times \frac{3}{4} = \frac{3}{32}$ .

Prob. 6. The questions having the same number are the reverse of each other; and the examples under the note are reversed by those under Prob. 7th.

*Follows the solution of the first question of each:*

$\frac{4}{9}$  farthing reduced to the fraction of a pound  $= \frac{4}{9} \times \frac{1}{4} \times \frac{1}{12} \times \frac{1}{16} = \frac{1}{360}$ , and  $\frac{1}{160}$  reduced to the fraction of a farthing  $= \frac{1}{160} \times \frac{1}{4} \times \frac{1}{12} \times \frac{1}{16} = \frac{1}{360}$  farthing.

Next,  $\frac{4}{7}$  reduced to the fraction of a guinea  $= \frac{4}{7} \times \frac{1}{20} = \frac{1}{35}$  guinea, &c.

Lastly,  $\frac{7}{16}$  reduced to the fraction of a pound  $= \frac{7}{16} \times \frac{1}{12} \times \frac{1}{16} = \frac{7}{384}$  &c.

# ADDITION.

(1.)  $\frac{637+504+624}{728} = \frac{1765}{728} = 2\frac{1}{2}$ . (2.)  $\frac{5+6+8}{11} = \frac{19}{11} = 1\frac{8}{11}$ .

(3.)  $2565+6460+2907+4590 = 16522 = 1\frac{1037}{14533}$ .

(4.)  $9384+8177+11914 = 39475 = 2\frac{141}{1467}$ .

(5.)  $231+160 = 391$ .

(6.)  $2574+2783+4140 = 9497 = 2\frac{389}{4554}$ .

(7.)  $45360+48384+24960+16200 = 134904 = 2\frac{158}{1460}$ .

(8.)  $1292+2508+2431 = 6231 = 1\frac{78}{1111}$ .

(9.)  $14364+5720 = 20084 = 1\frac{869}{1111}$ .

(10.)  $4+7+8+1\frac{1}{2} = 20\frac{1}{2}$ .

(11.)  $9+6+8+11+1\frac{1}{2} = 34\frac{1}{2}$ .

(12.)  $924+288+352+792 = 2356 = 2\frac{6}{164}$ , then  $6+14+51+2\frac{6}{164} = 73\frac{6}{164}$ .

(13.)  $77+640 = 717 = 8\frac{1}{16}$ .

\* Compound fractions must be reduced to simple ones by Prob. 4. before they are reduced to a common denominator.

† In the examples which follow, the denominator is omitted under the numerators, but is placed under their sum.

- (14.)  $24+400+576 = \frac{100}{84} = \frac{25}{21} = 1\text{ l } 1\text{ s } 3\text{ d.}$   
 (15.)  $33600+1600+336 = \frac{22200}{8400} = 3\text{ oz. } 3\text{ dwt } 10\frac{2}{3}\text{ gr.}$   
 (16.)  $900+4000+5376 = \frac{100176}{8000} = 1\text{ l } 1\text{ s } 4\frac{1}{2}\text{ d } \frac{1}{2}$   
 (17.)  $196+6240+10080 = \frac{16716}{8710} = 2\text{ l } 9\text{ s } 1\frac{1}{2}\text{ d } \frac{1}{2}$   
 (18.)  $40+48+32 = \frac{12}{1} = 1\text{ yard } 3\text{ qrs } 2\text{ nails.}$   
 (19.)  $3584+44800+1024000+259840 = \frac{1333344}{8000} = \frac{13333}{1000} = 13\text{ c. } 11\text{ lb. } 8\text{ oz. } 8\frac{8}{15}\text{ drs}$   
 then  $1\text{ l } + \frac{100}{8000} = 1\text{ l } 1\text{ s } 7\frac{1}{15}\text{ d.}$   
 (20.)  $80+16128+336000 = \frac{337788}{25600} = 13\text{ c. } 11\text{ lb. } 8\text{ oz. } 8\frac{8}{15}\text{ drs}$   
 (21.)  $576+80+18 = \frac{674}{136} = 5\text{ bush. } 2\frac{1}{13}\text{ pecks.}$   
 (22.) 4 days 10 hours 36 minutes, (23.)  $103\text{ l } 6\text{ s } 7\frac{1}{8}\text{ d.}$   
 (24.) 4 cwt 3 qrs 12 lb. 10 oz.  $9\frac{1}{2}\text{ dr.}$   
 (25.)  $54\frac{1}{2}\text{ y. } + 16\frac{7}{8}\text{ y. } + 37\frac{5}{8}\text{ y. } + 3\frac{1}{4}\text{ y. } = 112\frac{1}{2}\text{ yards.}$

*Subtraction.*

- |                       |                     |   |   |
|-----------------------|---------------------|---|---|
| 1. $\frac{23}{80}$    | 6. $\frac{73}{144}$ | 11. $12\frac{5}{8}$                                     | 16. $2\text{ l } 3\text{ s } 5\frac{1}{2}\text{ d } \frac{1}{10}$ |
| 2. $\frac{50}{144}$   | 7. $\frac{1}{8}$    | 12. $9\frac{3}{40}$                                     | 17. $108-81 = 27\frac{7}{8}$                                      |
| 3. $\frac{312}{372}$  | 8. $3\frac{1}{12}$  | 13. $12\text{ s } 1\frac{1}{2}\text{ d } \frac{20}{11}$ | 18. $13\frac{5}{8} - 7\frac{6}{8} = 5\frac{7}{8}$                 |
| 4. $\frac{801}{1125}$ | 9. $4\frac{1}{4}$   | 14. $14\text{ s } 5\frac{1}{2}\text{ d } \frac{9}{7}$   | 19. $1 - \frac{3}{10} = \frac{7}{10}$                             |
| 5. $\frac{17}{114}$   | 10. $14\frac{1}{4}$ | 15. $1\text{ c } 7\frac{1}{2}\text{ d } \frac{6}{11}$   | 20. $\frac{4}{15} = 25\text{ g. } 2\frac{2}{3}\text{ p.}$         |

*Multiplication\*.*

- (13.)  $\frac{5}{8} \times \frac{17}{8} = \frac{85}{64} = 1\text{ l } 1\text{ s } 9\frac{1}{2}\text{ d } \frac{1}{2}$ . (14.)  $19\text{ s } 5\frac{1}{2}\text{ d } \frac{1}{11}$ .  
 (15.)  $6\text{ l } 7\frac{1}{11}\text{ s.}$  (16.)  $1\text{ l } 1\text{ s } 3\frac{1}{2}\text{ d.}$  (17.)  $4\text{ s } 3\frac{1}{2}\text{ d } \frac{1}{4}$ .  
 (18.)  $12\text{ l } 4\text{ s } 3\frac{1}{2}\text{ d } \frac{1}{11}$ .

*Division.*

- (13.)  $38\frac{7}{8} \div 7\frac{5}{7} = \frac{311}{8} \div \frac{54}{7} = \frac{311}{8} \times \frac{7}{54} = \frac{2177}{432} = 5\text{ s } 0\frac{1}{4}\text{ d } \frac{5}{8}$ .  
 (14.)  $16\text{ s } 9\frac{1}{11}\text{ d.}$  (15.)  $13\text{ s } 4\frac{1}{2}\text{ d } \frac{6}{7}$ . (16.)  $\frac{19}{11}$ .  
 (17.)  $1926\frac{468}{800}$ . (18.)  $45\text{ l } 15\text{ s } 3\frac{1}{11}\text{ d, and } 23\text{ l } 9\text{ s } 2\frac{1}{4}\text{ d } \frac{11}{16}$ .

*Proportion.*

- (1.)  $\frac{1}{2} : \frac{7}{8} :: \frac{12}{2} : \frac{1}{2} \times \frac{7}{8} \times \frac{12}{2} = \frac{66}{16} = 3\text{ l } 1\text{ s } 6\frac{1}{2}\text{ d } \frac{5}{8}$ .  
 (2.)  $2\text{ l } 14\text{ s } 3\frac{1}{2}\text{ d } \frac{1}{2}$ . (3.)  $2\text{ s } 5\frac{1}{2}\text{ d } \frac{1}{11}$ . (4.)  $8\text{ l } 5\text{ s.}$   
 (5.)  $6\text{ l } 16\text{ s } 8\frac{1}{2}\text{ d } \frac{1}{2}$ . (6.)  $1\text{ l } 9\text{ s } 7\text{ d.}$  (7.)  $26\text{ cl } 11\text{ s } 1\frac{1}{2}\text{ d } \frac{1}{2}$ .  
 (8.)  $322\text{ l.}$  (9.)  $1\text{ l } 17\text{ s } 1\frac{1}{2}\text{ d } \frac{6}{11}$ . (10.)  $56\text{ yds } 3\frac{1}{11}\text{ nails.}$

\* The first twelve questions here are the reverse of the first twelve in division.



- (11.) 200 ft  $5\frac{1}{11}$  in. (12.) 400 l 14 s  $3\frac{1}{4}d\frac{1}{2}$ .  
 (13.) 13 m.  $19\frac{299}{800}$  days. (14.) 1 lb.  $4\frac{1}{11}$  dwt.  
 (15.) By the question A. performs  $\frac{1}{8}$  of the work in 1 day, B.  $\frac{1}{10}$ , and C.  $\frac{1}{14}$ ; then  $\frac{1}{8} + \frac{1}{10} + \frac{1}{14} = \frac{53}{560} =$  the part of the work done by the whole in 1 day; therefore,  $53 : 1 :: 360 : 6\frac{42}{53}$  days.

*Exercises.*

- (1.)  $23 = 22\frac{2}{3}$ ,  $34 = 33\frac{1}{3}$ , &c. (2.)  $10 = 9\frac{9}{10}$ ,  $100 = 99\frac{9}{10}$ , &c.  
 (3.)  $967680 + 80064 + 1090560 = \frac{21101804}{512} \text{ lb. which } \times 5\frac{1}{11} \text{ t} = 27 \text{ l } 10 \text{ s } 10\frac{1}{4}d\frac{4}{11}$ . (4.)  $\frac{1}{4}\frac{1}{10}$ . (5.)  $18\frac{1}{10}$  g.  
 (6.)  $2\frac{1}{11}$  pks, and  $\frac{47}{100}$  pts. (7.)  $\frac{250971}{10048} = 122\frac{111}{1048}$  lb.  
 (8.)  $\frac{1}{8} \times \frac{281}{144} \times \frac{1}{110} = \frac{8729}{17600} = 1 \text{ l } 4\frac{1}{2}d\frac{49}{80}$ . (9.) 2100 l.  
 (10.)  $75 \text{ l } 11 \text{ s } 1\frac{1}{10}d$ . (11.)  $78\frac{2}{3} \div 4\frac{2}{3} = 19\frac{2}{3} \div \frac{1}{3} = 16 \text{ l } 16 \text{ s a man's share.}$  (12.) 990 l. (13.)  $5 \text{ l } 12 \text{ s } 6d$ .  
 (14.) 3 l 3 s. (15.)  $6 \text{ s } 10\frac{1}{4}d\frac{1}{2}$ . (16.)  $\frac{1}{11} \times \frac{1}{11} \times \frac{1}{11} \times \frac{1}{11} \times \frac{1}{11} = \frac{1}{16105} = 2 \text{ l } 10 \text{ s } 10\frac{1}{4}d\frac{1}{11}$ . (17.)  $\frac{1}{4} \text{ y.} : \frac{1}{18} \text{ y.} :: \frac{67}{18} \text{ y.} : 144\frac{49}{11} \text{ yds.}$  (18.)  $\frac{1}{11} \times \frac{6}{11} \times \frac{1}{11} \times \frac{1}{11} \times \frac{1}{11} = \frac{1}{1771} = 19\frac{2}{11} \text{ yds.}$   
 (19.) 12 s. (20.)  $\frac{1}{2} + \frac{1}{4}$ , &c.  $= \frac{1}{10} = 110$  by the question, therefore  $11 : 110 :: 10 : 100$  number of goats. Next,  $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16}$ , &c.  $= \frac{1}{4} = 500$  by the question, and last step whence  $5 : 500 :: 4 : 400$  number sheep. (21.)  $2\frac{1}{11}\frac{1}{11}$  h.  
 (22.)  $\frac{1}{11} + \frac{1}{11} = \frac{2}{11}$  and  $\frac{1}{11} - \frac{2}{11} = -\frac{1}{11} = \frac{87}{1100} = \text{C's part for 1 day, then } 87 : 1 :: 2200 : 25\frac{2}{11}$  days.

*Decimal Fractions.*

- Addition.* (1.) 6637.872625. (2.) 104.30009. (3.) 966.609554. (4.) 246.0884. (5.) 105.2592494.  
*Subtraction.* (6.) 35.77, 80.438504, 2.18693, .2978, .21.5846, 3.627, and .000691.

*Multiplication.*

1. 50387.0389 4. .0009282 7. 6.19014 10. 18.164  
 2. 59728.5838 5. 2.7321 8. .633654 11. .4986  
 3. .0646263 6. 19.54 \* 9. .000312 12. .648

*Division.*

1. .1331 4. 416.1857 7. 3138758 10. 1105.363545  
 2. .61436 5. 3.157947 8. 116648.16 11. 22.93  
 3. 79.347 6. .003596 9. 111.359 12. 7.48635

\* When the multiplier is a repeater, it will be most accurate to use its equivalent vulgar fraction instead of it.

*Reduction.*Prob. 1. Example 1.  $\frac{1}{4} = 8) 1.000(.125$ 

2. .625	8. .111 &c.	14. .00533	20. .2727
3. .5	9. .833	15. .6363	21. .076923
4. .25	10. .1666	16. .7272	22. .0101
5. .75	11. .5625	17. .44	23. .2037
6. .875	12. .2	18. .8181	24. .666
7. .333	13. .0133	19. .142857	25. .94118

Prob. 2. Example 1.  $.5 = \frac{5}{10} = \frac{1}{2}$ .

(2.) $\frac{1}{2}$ .	(3.) $\frac{1}{4}$ .	(4.) $\frac{1}{8}$ .	(5.) $\frac{5}{8}$ .	(6.) $\frac{1}{10}$ .	(7.) $\frac{3}{4}$ .
(8.) $\frac{1}{100}$ .	(9.) $\frac{1}{100}$ .				

*Examples to the note.*

(1.) $6 = \frac{6}{1} = \frac{2}{1}$ .	$.81 = \frac{81}{100} = \frac{9}{11}$ .	$.09 = \frac{9}{100} = \frac{1}{11}$ .	$.83 = \frac{83}{100}$ .
$= \frac{75}{100} = \frac{3}{4}$ and $.812 = \frac{812}{1000} = \frac{1015}{1250}$ .			
(2.) $\frac{8}{11}$ .	(3.) $\frac{41}{100}$ .	(4.) $\frac{101}{1100}$ .	(5.) $\frac{185}{999}$ .
(6.) $\frac{27}{10}$ .	(7.) $\frac{11}{11}$ .	(8.) $\frac{111}{101}$ .	(9.) $\frac{411}{999}$ .
(10.) $\frac{1}{1}$ .	(11.) $\frac{1}{1}$ .	(12.) $\frac{17+89}{1999}$ .	

Con. I. Ex. 1. .3277	(2.) 3.7.	(3.) 3.1407	
II. (1.) .2349	(2.) .1871	(3.) .1331	(4.) .2311
III. 1. .435	4. .734	7. 4.525	10. 7.786
2. .367	5. .672	8. 3.429	11. 2.656
3. .478	6. .890	9. 4.335	12. 3.834
IV. 1. 8s 11 $\frac{1}{2}$ d	4. 13s 6 $\frac{1}{2}$ d	7. 4l 19s 7 $\frac{1}{2}$ d	10. 15s 11 $\frac{1}{2}$ d
2. 6s 6d	5. 18s 1d	8. 6l 14s 10 $\frac{1}{2}$ d	11. 17s 4 $\frac{1}{2}$ d
3. 2l 10s 8d $\frac{1}{4}$	6. 16s 4 $\frac{1}{2}$ d	9. 4l 19s 11 $\frac{1}{2}$ d	12. 17s 5 $\frac{1}{2}$ d

*Interest.*

1. 16l 4s 10 $\frac{1}{2}$ d	4. 8l 2s 9 $\frac{1}{2}$ d	7. 32l 5s 6 $\frac{1}{2}$ d	10. 10l 11 $\frac{1}{2}$ d
2. 3l 17s 9 $\frac{1}{2}$ d $\frac{11}{16}$	5. 3l 17s 4d	8. 3l 12s 11 $\frac{1}{2}$ d	11. 5l 7s 8 $\frac{1}{2}$ d
3. 3l 7s 4 $\frac{1}{2}$ d	6. 16l 9s 6 $\frac{1}{2}$ d	9. 4l 9s	12. 2l 10s 3d
13. March 12. due	500 $\times$ 26 days = 13000.		
April 7. paid	<u>150</u>		
Balance	350 $\times$ 82 days = 28700.		
June 28. paid	<u>200</u>		
Balance	150 $\times$ 79 days = 11850.		
September 15. paid	<u>150</u>		
	365 $\times$ 20 = 7300) 53550 (7l 6s 8 $\frac{1}{2}$ d $\frac{1}{4}$		

# INTEREST.

135

$$14. 456 \times 42 = 19152$$

$$336 \times 101 \quad 33936$$

$$220 \times 51 \quad 11220$$

$$84 \times 40 \quad 3360$$

$$\underline{7300) \quad 67668}$$

Answer.  $9l \ 5s \ 4\frac{1}{2}d$

$$15. 1000 \times 25 = 25000$$

$$700 \times 36 \quad 25200$$

$$466 \times 76 \quad 35416$$

$$236 \times 82 \quad 19352$$

$$\underline{7300) \quad 104968}$$

$14l \ 7s \ 7d$

$$16. 900 \times 58 = 52200$$

$$750 \times 30 \quad 22500$$

$$480 \times 81 \quad 38880$$

$$307 \times 39 \quad 11973$$

$$94 \times 57 \quad 5358$$

$$37 \times 55 \quad 2035$$

$$\underline{7300) \quad 132946}$$

$£. \ 18 \ 4 \ 2\frac{1}{2}$

$$17. 1000 \times 181 = 181000$$

$$700 \times 95 \quad 66500$$

$$550 \times 64 \quad 35200$$

$$330 \times 150 \quad 49500$$

$$\underline{7300) \quad 332200}$$

Inter.  $£. \ 45 \ 10 \ 1\frac{1}{2}$

$$18. 2000 \times 77 = 154000$$

$$1650 \times 174 \quad 287100$$

$$960 \times 81 \quad 77760$$

$$540 \times 110 \quad 59400$$

$$\underline{7300) \quad 578260}$$

Inter.  $£. \ 79 \ 4 \ 3\frac{1}{2}$

$$20. 250 \times 38 = 9500$$

$$126 \times 20 \quad 2520$$

$$266 \times 21 \quad 5586$$

$$36 \times 23 \quad 828$$

$$376 \times 70 \quad 26320$$

$$226 \times 23 \quad 5198$$

$$447 \times 30 \quad 13410$$

$$\underline{63362}$$

4

$$\underline{36500) \quad 253448}$$

$6l \ 18s \ 10\frac{1}{2}d$

$$19. 210 \times 59 = 12390$$

$$360 \times 38 \quad 13680$$

$$230 \times 24 \quad 5520$$

$$470 \times 50 \quad 23500$$

$$255 \times 24 \quad 6120$$

$$555 \times 23 \quad 12765$$

$$388 \times 36 \quad 13968$$

$$638 \times 24 \quad 15312$$

$$358 \times 37 \quad 13246$$

$$238 \times 36 \quad 8568$$

$$\underline{7300) \quad 125069}$$

$17l \ 2s \ 7\frac{1}{2}d$

11.  $100 : 66d :: 86\frac{4}{11} : 4s\ 9d$  18.  $12c\frac{5}{8} : 58d :: 100 : 4s$   
 12.  $100 : 5\frac{1}{2}d :: 156\frac{1}{11} : 9d$  19.  $126\frac{6}{11} : 12 :: 100 : 9s\ 6d$   
 13.  $100 : 4s :: 120\frac{5}{8} : 4s\ 10d$  20.  $5s : 112 :: 6s : 134\frac{2}{7}$  then  
 14.  $109\frac{1}{11} : 4s :: 100 : 3s\ 8d$   $134\frac{2}{7} - 100 = 34\frac{2}{7}$  anf.  
 15.  $90 : 13s\ 6d :: 100 : 15s$  21.  $16 : 86 :: 15 : 8c\frac{5}{8}$ , then  
 16.  $86\frac{4}{11} : 57d :: 100 : 5s\ 6d$   $100 - 80\frac{5}{8} = 19\frac{3}{8}$  anf.  
 17.  $156\frac{1}{11} : 9 :: 100 : 5\frac{1}{2}d$  22.  $24\frac{3}{11} : 23. \frac{1}{4}$  lofs.

*Exercises.*

1.  $17s$  gain,  $6\frac{2}{3}$  per cent. 7.  $1s\ \frac{1}{4}d$ ,  $\frac{1}{4}$  per lb.  
 2.  $18l\ 4s\ 6d$ ,  $54$  per cent. 8.  $12s$ ,  $\frac{2}{3}$  per cent.  
 3.  $15s\ 10d$ ,  $5\frac{5}{8}$  per cent. 9.  $10s\ 2\frac{1}{4}d$ ,  $\frac{1}{9}$  per gal.  
 4.  $9s\ 4\frac{1}{2}d$ ,  $\frac{1}{8}$  per gal. 10.  $3\frac{1}{2}$  lofs.  
 5.  $28l\ 19s\ 10d$ ,  $58\frac{1}{3}$  per cent. 11.  $10$  per cent.  
 6.  $4s\ 7\frac{1}{2}d\ \frac{1}{11}$ .  
 12.  $474l\ 5s\ 8d - 413l\ 4s\ 8d = 61l\ 1s$  gain.  
 13. The barley, rent, and wages make  $2285l$ ,  $1600$  bushels malt at  $2s\ 11\frac{3}{4}d$  (duty deducted) amount to  $2383\frac{1}{4}l$ , therefore  $98l\ 6s\ 8d$  gain.  $4\frac{4}{11}\frac{1}{11}$  gain per cent.  
 14.  $2440l\ 16s\ 4d - 2240l\ 1s = 200l\ 15s\ 4d$  gain.  
 15.  $3618.725l - 3510.725l = 108l$  gain,  $3\frac{2}{3}\frac{1}{11}\frac{2}{11}$  per cent.  
 16.  $3s$  prime cost and  $960$  yards.  
 17. The pref. worth of  $1l\ 4d$  due  $4$  m. hence is  $1l$ , whence  $15l : 5s :: 100 : 33\frac{2}{3}$  per cent.  
 18.  $100 : 12 :: 110 : 13s\ 4d$ , and  $100 : 13s\ 4d :: 102\frac{1}{2} : 13s\ 8d$ .  
 19.  $26l\ 5s$  is the amount of  $25l$  for a year, also  $5s\ 4d$  per lb. is  $29l\ 17s\ 4d$  per cwt, the present worth of which is  $28l\ 18s\ \frac{1}{4}d\ \frac{1}{11}$ , and therefore  $2l\ 13s\ \frac{1}{4}d\ \frac{1}{11}$  gain,  $2\frac{2}{11}\frac{1}{11}$  p. cent.

*Exchange.**Ireland.*

1.  $108 : 100 :: 972 : 900l$   
 2.  $100 : 109 :: 385 : 419l\ 13s$   
 3.  $482l\ 6s\ 0\frac{1}{2}d$   
 4.  $746l\ 17s\ 6d$

*America.*

1.  $140 : 100 :: 672 : 480l$   
 2.  $6000l\ 1\frac{1}{2}d\ \frac{1}{11}$   
 3.  $929l\ 12s\ 1\frac{1}{2}d$   
 4.  $11544l\ 8s$

*Holland.*

1.  $100 : 104.75 :: 48750 : 51065.625$  guild. =  $51065$  g.  
 12 R. 8 pen.

2. 102.25:100 :: 7864:7690.9535 g. b.=7690 g. 19 ft. 11 $\frac{1}{2}$  p.
3. 34 $\frac{1}{2}$ ×12.: 1/ :: 7846×40:758.067 $\frac{1}{2}$ =758/ 1s 4 $\frac{1}{2}$  $\frac{5}{8}$ d.
4. 1s: 438d.fl.: 4850l: 212430d, and 40) 212430(53107 $\frac{1}{2}$ g.\*
5. 35 $\frac{1}{2}$ ×12.: 1 :: 854×40: 481/ 2s 6 $\frac{1}{4}$  4 $\frac{1}{2}$ d.
6. 1/ : 435 d. fl.: 648/ : 281880d fl.=1174/ 10s Flemish.
7. 102.75 : 100 :: 7860 : 7649.635 guilders banco, then 422d. fl. : 1/ :: 7649.635×40: 725.083=725/ 1s 8d ster.
8. 1/ ster.: 426d. fl. :: 4050l : 1725300 d.=43132.5 g. then 100:103::43132.5:44426.475 g. cur.=44426 g. 9ft. 8pen.
9. 1s 9 $\frac{1}{4}$ d 4 $\frac{1}{2}$  11.12051/ 16s 1 $\frac{1}{2}$ d fl. 13. 1589/ 19s 1 $\frac{1}{2}$ d.
10. 1s9d nearly 12.4597/ 4s 2 $\frac{1}{4}$ d 1 $\frac{1}{2}$  ster. 14. 461/ 19s 1 $\frac{1}{4}$ d 1 $\frac{1}{2}$

*Hamburg.*

1. 400 d.: 1/ :: 269600×32 : 21568/ ster. 2. 122409 ml.
3. 33 $\frac{1}{2}$  ft. : 2 m.l. :: 8468×20 : 10111 m. lubs
4. 4005 g. 9 ft. 5. 872/ 10s 3d. 6. 6928 ml. 24 fl.
7. 103 : 100 :: 4892 : 4749.514563 guild. banco, 32.75 : 2 :: 4749.5145×20 : 5800.933813 m. l. banco, 100 : 118.5 :: 5800.933813 : 6874.106=6874 m.l. 1fl.cur.
8. 2995 guild. 4 fliv. 9. 30336 marc lubs.

*France.*

1. 3 liv. : 30 $\frac{1}{4}$ d :: 480 liv. : 20l 6s 8d 2. 2160 liv.
3. 3 liv. : 28 $\frac{1}{2}$  ft. :: 480 : 16×28 $\frac{1}{2}$ =228 g. 4. 10210 $\frac{1}{4}$  $\frac{9}{17}$  liv.
5. 8964× $\frac{1}{14}$  = 4108.5 g. ban. = 4252.2975 g. cur. = 4252 g. 5 ft. 15 $\frac{1}{2}$  p.
6. 28 $\frac{1}{4}$  : 3 livres :: 1492116.5 ft. banco : 158454.85 livres = 158454/ 17s
7. 26 $\frac{1}{2}$  : 3 :: 74880 : 84769/ 16 fols.

*Portugal.*

1. 67.5 : 1 mil. :: 101250d : 1500 milrees
2. 1420000 rees ÷ 144 = 9861.1 livres.
3. 400: 48 :: 8460000 : 1015200d, ban.=26141 g. 8 ft. cur.
4. 4.8×67 $\frac{1}{2}$  = 324d = 27s moid. and 6.4×67 $\frac{1}{2}$  = 432d = 36s joannes.
5. 480×68d = 136l. 6. 2906×430 = 1249 mil. 58 rees.

Or, 212430 ÷ 40 = 53107 $\frac{1}{2}$  g. in the same manner understand the like where it occurs in some of the fol. solutions.

*Spain.*

1. 8 r. : 42d :: 1500 r. :  $21 \times 375 = 7875d = 32l\ 16s\ 3d$ .
2. 375 : 112 : 306000 marv. :  $91392\ d.\ b. = 2284\ g.\ 16\ ft.\ cur.$
3.  $12375 \times 80 = 990000$  rees = 990 milrees.
4. 41 : 8 :: 20594d : 4018.34 which  $\times \frac{1}{17} = 7564\ r.\ v.$  nearly.
5. 108 : 375 :: 37159.2233 ft. ban. : 3794.8553 r. p.
6. 4260 : 32 r. p. :: 1036244 den. : 7784 r. p. nearly.

*Italy.*

1.  $7860 \times 52 = 408720d = 1703l$ .
2. 51)483480(9480 ducats.
7. 51 : 6 lires :: 159630d : 18780 lires.
8. 62 :  $7\frac{1}{2}$  :: 31806d : 3847.5 lires = 3847 lires 10 fols.
9. 1 cr. : 71d ::  $1404 \times \frac{10}{17} = 1170$  flam. cr. : 346l 2s 6d.
10.  $1102 \times 40d = 183\ 13s\ 4d$ .
11.  $5\frac{1}{2}l\ lir.$  : 108 :: 4878 : 91621.5 fols = 4581 liv. 1s 6d.
12. 7.5 : 380 :: 5512.5 : 27930 marv. = 8214 r. 24 marv.
13.  $1890 \times 92 = 173880d = 4347$  guilders.
14.  $7\frac{1}{2}$  lires : 91 ::  $3720 \times \frac{4}{7} = 36108.8d$ . ban. = 41525.12d.  
cur. = 1297.66 marc lubs current.
15. 66 : 100 ::  $8664 \times \frac{1}{12} = 10939\frac{1}{3}$  ducats.
16. 428 :  $7\frac{1}{2}$  ::  $1890 \times 34 = 1126$  lires 1 fol.

*Denmark and Norway.*

1.  $6780 \times 4\frac{1}{2} = 30510\ R.$
2. 464 flk.)860584 flk.(1854l 14s  $1\frac{1}{2}d$ .
3. 104)25417600(244400 g. banco, which  $\times \frac{1}{7} = 97760\ R.$   
then 100 :  $108\frac{1}{2}$  :: 97760 : 106069 R. 3 m.  $9\frac{1}{2}$  flk.
4.  $109)828400(7600\ R. \times 2\frac{1}{2} = 1900\ g.\ b. = 19570\ g.\ cur.$
5. 254 ml. : 100 R. :: 5300 ml. ban. : 2086.614 = 2086 R.  
3 m. 10 flk.
6. 100 R. : 255 :: 6780 R. 17289 ml = 20401.02 ml. cur.

*Sweden.*

1. 40.5 : 1l :: 47790 : 118cl.
2.  $55576\frac{1}{2}$  cop. dol.
3.  $12\frac{1}{2} \times \frac{1}{4} : 2\frac{1}{2}\ g. :: 52269 : 13938\ g.\ 8\ ft.$
4. 4200 cop. dol.
5.  $12 \times \frac{1}{4} = 9 : 3 :: 7857 : 2619\ ml.$
6. 36666 cop. dol.

*Poland and Prussia.*

1.  $13\frac{1}{2}$  : 1 flor. :: 138240d : 10240 flor.
2. 449l 19s  $11\frac{1}{2}d$ .
3. 6 g. : 305 :: 2780 : 4710 f.  $16\frac{2}{3}\ gr.$
4.  $2180 \times \frac{4}{7} = 2906\frac{2}{7}\ f.$

# EXCHANGE.

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5. 6 g.: 315 :: 89615.75  $\times \frac{4}{17}$  : 4590075 gr. = 153002  $\frac{1}{2}$  flor.
6. 3 : 312 :: 1387.5 m.l. banco : 144300 gr. = 4810 florins.
7. 306 gr. : 6 g. :: 229500 gr. : 4500 g. ban. = 4725 g. cur.

## Russia.

1. 1785  $\times$  53d = 394l 3s 9d
2. 105 : 3 :: 178500 : 5100 m.l.
3. 364l 13s 10d
4. 6436  $\times \frac{48}{107}$  = 1492l 8s 1  $\frac{1}{2}$ d
5.  $\begin{cases} 108.3 :: 216000 : 6000 \text{ m.l.} \\ 399d ) 192000d ( 481/4s \frac{1}{2}d \end{cases}$
6. 1728
- 200  $\overline{) 86400}$
- 432 com.
- 312ft.  $\overline{) 86832}$
- 409l 11s 8d ster.
7. 377l 4  $\frac{1}{2}$ d.

## Drawing and Remitting.

1. 30d : 1200l :: 32d : 1280l and 1280l — 1200 = 80l gain.
2. 110 : 480 :: 106 : 462l 10s 10  $\frac{1}{2}$ d  $\frac{7}{8}$ .
3. 106.5 : 960 :: 109 : 982.535 whence 22l 10s 8  $\frac{1}{2}$ d loss.
4. 33s 6d : 1000 :: 36s 4d : 1084.577l, whence 84l 11s 6  $\frac{1}{2}$ d loss
5. 406d : 6000 :: 440d : 6502.463, 502l 9s 3  $\frac{1}{2}$ d loss, 8.374 per cent.
6. 105 : 780.75 :: 108 : 803l 1  $\frac{1}{2}$ s.
7. 410) 1752000 ( 4273.17l, 273l 3s 5d gain, 6.829 per cent.
8. 40 : 750l :: 45d : 843l 15s, 93s 15s gain, 12  $\frac{1}{2}$  per cent.

## Arbitration.

1. 5 = 6 that is 6 = 5
- 4 = 7  $\frac{1176 \times 4 \times 5}{7+6} = \frac{1760}{21} = 560$  yds Engl. and 7 = 4
- 5 = 5
- 1176 = ? 100 = 5

that is  $\frac{100 \times 7 \times 6}{4 \times 5} = 210$  yds Ham.

2.  $\frac{416 \times 64}{68} = 32s 7s \frac{2}{7}d$ .
4.  $\frac{240 \times 65 \times 52}{426 \times 32} = 29 \frac{10}{12} \frac{1}{4}d$ .
3.  $\frac{414 \times 66}{64} = 35s 6 \frac{1}{8}d$ .
5.  $\frac{240 \times 50 \times 1000}{410 \times 400} = 73 \frac{7}{1}d$ .

## Exercises.

1. 1804l cur.
3. 2532l 15s.
5. 32s stem.
7. 1320l
2. 131l 6s 6d
4. 1778l 1s 11  $\frac{1}{2}$ d
6. 82l 13s 4d
8. 3364.4 g.

9.  $112 : 100 :: 7909.5 : 7062.053$  R. banco + 17.655 com.  
 $= 7079.708$  R. 211 stivers : 11 ::  $7079.708 \times 50 : 1677$   
 13s  $1\frac{1}{2}d$  ansf.
10.  $240 : 397d$  fl. ::  $259744 : 429659.86$  pence Flemish.  
 $8128d$  fl. : 100 R. ::  $429659.86 + 1074.15$  com. :  $5299.38$   
 R. Danish.
11.  $1000 \times 1\frac{1}{2} = 75l$  directly.  $3 : 32.5 :: 1000 : 16250$ , and  
 $16250 \div 215 = 75l$  11s  $7\frac{1}{2}d$ , by Holland.
12.  $1500 \times 14.9 = 22350$ , and  $22350 - 670.5 = 21679.5$   
 piafters,  $21679.5 \times 53\frac{1}{2}d = 1154433.375d = 4810l$  2s  
 $9\frac{1}{2}d$   $\frac{1}{2}$  sterling.
13.  $45000l - 44117l$  12s  $14\frac{1}{2}d = 882l$  7s  $\frac{1}{2}d$  gain.
14.  $8760 \times 56d = 2044l$  directly.  $8760 \times 48.5 = 424860$  fliv.  
 which  $\div 215 = 1976l$  1s  $10\frac{1}{2}d$  on Holl. Next,  $106 : 3$   
 $:: 876000 : 24792.4528$ , which  $\times \frac{3}{40s} = 1973l$  10s  $6\frac{1}{2}d$   
 on Hamburgh.
15.  $1500 \times 27\frac{1}{2} = 13750$  fliv. which  $\div 220$  fliv. =  $62l$  10s.
16.  $4.75)8400(1768l$  8s  $5d$  dir. and  $108.5)840000(7741.935$   
 $+ 38.709$  com. =  $7780.644$  which divided by  $431 =$   
 $1805l$  5s  $1d$  on Hol.
17.  $4148l$  2s  $11\frac{1}{2}d$ . 18.  $4104 - 3971.76 = 132.24$  crowns  
 gained.
19.  $7896 \times 22\frac{1}{4} = 744l$  7s  $3d$ .  $102)789600(7741.176$  g. b.  
 $+ 38.705$  com. =  $7779.881$  g. =  $155597.62$  fliv. then  
 $215)155597.62(723.71 + 7.237$  com. =  $730l$  18s  $11\frac{1}{2}d$ , then  
 $744l$  7s  $3d - 730l$  18s  $11\frac{1}{2}d = 13l$  8s  $3\frac{1}{2}d$  gain.
20.  $117l$  3s  $\frac{1}{2}d$  on London,  $115l$  14s  $8\frac{1}{2}d$  on Holland.
21.  $4800 \times 3\frac{1}{2}s = 840l$  directly,  $136.75)480000(3510.9548 +$   
 $17.55027 = 3527.60507$  R. and  $3527.60507 \times 100 \div 420$   
 $839l$  18s  $1\frac{1}{2}d$  on Holland. Next,  $126 : 100 :: 4800 =$   
 $3529.41176 + 17.64705 = 3547.05882$  R. which  $\times 8$  [8s  
 gros = rix dol.] and  $\div 34 = 834l$  12s  $\frac{1}{2}d$  by Hamb.
22.  $479l$  4s  $7d$  by Hol.  $495l$  9s  $8d$  by Hamb.
23.  $213$  ft. : 11 ::  $96000$  ft. :  $450.704 + 7.511$  int. for 4 m.  
 $= 458.215l$ . Again,  $212$  ft. : 11 ::  $96480$  ft. :  $455.094$ ,  
 $458.215 - 455.094 = 3.121l = 3l$  2s  $5\frac{1}{2}d$  gain.
24. First,  $1956\frac{1}{2}$  yds at  $16\frac{1}{2}d = 134l$  10s  $2\frac{1}{2}d$  and  $1620$  yds  
 at  $14d = 94l$  10s, the sum of which is  $229l$   $2\frac{1}{2}d$ . Again,  
 $1955\frac{1}{2}$  yds at  $713$  rees +  $1620$  yds at  $624$  rees =  $2405.8645$   
 milrees, deduct  $84.2052$  commif. and  $1470$  m. leaves  
 $851.6593$  m8 fl. for due, to which add  $1617$  milrees, ad-  
 vanced invoice, makes  $2468.6593$  mil. which at the given



# SQUARE ROOT.

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rate of exchange is 704/ 11s 11½d, whence the gain is 475/ 11s 9d.

*Involution.* 1. 279841. 2. 28629151. 3. 1444 inches  
4. 125 feet. 5. 3375 cubes.

## Square Root.

1. 576(24 root.

$$\begin{array}{r} 4 \\ 44 \overline{)176} \\ \underline{176} \\ \dots \end{array}$$

2. 20736(144 root.

$$\begin{array}{r} 1 \\ 24 \overline{)107} \\ 4 \ 96 \\ \underline{284} 1136 \\ \underline{1136} \\ \dots \end{array}$$

3. 789

4. 888

5. 1111

6. 70809

7. 9748

8. 123456789

9. 8070405

10. 73

11. 2.4238<sup>19356</sup>

12. 698.343<sup>54351</sup>

13. 956.49<sup>8799</sup>

14. 2480.795+

15. 2.236068—

16. 4.16

17. .91

18.  $\frac{7}{11}$ ,  $\frac{2}{11}$ , and  $\frac{3}{8}$ .

19. .86644

20. .027

21. 28.0067—

22. 8.266<sup>0577</sup>

23. 22.0479+

24. .0028

25. 3.316625

26. .000073

## Problems.

1.  $\sqrt{4 \times 36} = 12$

2. 30.74

3. .8862

4. 21.9089 poles

5.  $\sqrt{6400 \times 3} = 138.564$

6. 44.079 poles

7.  $\sqrt{3168} = 56.3—$

8.  $273 - 1 \times 18 = 4896$  feet

9.  $\sqrt{60 \times 60 \times 5} = 134.164$

10. 807 breadth

11.  $\sqrt{820 \times 3} = 49.6—$

13. 215.4

14. 375—

15. 334.185

16. 203.039 miles

17. 139.08 feet.

## CUBE ROOT.

*Cube Root.*

$$1. \quad \begin{array}{r} \overset{\cdot}{1}\overset{\cdot}{5}\overset{\cdot}{6}\overset{\cdot}{2}\overset{\cdot}{5} (25 \text{ root} \\ \underline{8} \end{array}$$

$$1200)7625$$

$$\underline{300}$$

$$\underline{25}$$

$$1525 \times 5 = 7625$$

....

$$2. \quad \begin{array}{r} \overset{\cdot}{2}\overset{\cdot}{1}\overset{\cdot}{0}\overset{\cdot}{2}\overset{\cdot}{4}\overset{\cdot}{5}\overset{\cdot}{7}\overset{\cdot}{6} (276 \text{ root} \\ \underline{8} \end{array}$$

$$1200)13024$$

$$\underline{420}$$

$$\underline{49}$$

$$1660 \times 7 = 11683$$

$$218700)1341576$$

$$\underline{4860}$$

$$\underline{36}$$

$$223596 \times 6 = 1341576$$

.....

$$3. \quad \begin{array}{r} 52734375 (375 \\ \underline{27} \end{array}$$

$$23734$$

$$\underline{23613}$$

$$2081375$$

$$\underline{2081375}$$

.....

$$4. \quad \begin{array}{r} 490982336369 (7889 \\ \underline{343} \end{array}$$

$$147982$$

$$\underline{131552}$$

$$16430336$$

$$\underline{14751872}$$

$$1678464369$$

$$\underline{1678464369}$$

.....

$$5. \quad \begin{array}{r} 1371737997260631 ( \\ \underline{1} \end{array}$$

[111111 root.

$$371$$

$$\underline{331}$$

$$40737$$

$$\underline{36631}$$

$$4106997$$

$$\underline{3699631}$$

$$407366260$$

$$\underline{370329631}$$

$$37036629631$$

$$\underline{37036629631}$$

$$6. \quad \begin{array}{r} 67459354004042485129 (40- \\ \underline{64} \end{array}$$

[70809 root.

$$3459354$$

$$\underline{3419143}$$

$$40211004042$$

$$\underline{39763574912}$$

$$447429130485129$$

$$\underline{447429130485129}$$

# ALLIGATION.

125

7. 219365327791(6031 r. 8. 344237608531512161929(  
216 343 [7008409 root.

3365327  
3256227  
109100791  
109100791

1237608531  
1177344512  
60264019512  
58937840704  
1326178808161929  
1326178808161929

9. 345 root.  
11. 18.93 531043.  
13. 1.442 1557112  
15. 9.2235 3044802125

10. 7856 root.  
12. 19.862 334788072  
14. .0045  
16. 41.378 1117257848

17. .020942+  
18.  $\frac{6}{7}, \frac{1}{8}, \frac{1}{12}$ .  
19. 1.912  
20.  $22\frac{1}{2}$

21.  $\sqrt[3]{36 \times 36 \times 36 \times 6\frac{1}{2}} = 66.6$  feet.  
22. 154.446 feet.  
23. 21.8 inches.  
24. 69.22 in. 57.69 in. 43.26 inch.

## Progressions.

1. dif. 3. sum 297  
2. 4s and 17l 11s  
3. 4s and 99s  
4. 25 and 1375  
5. 31 and 961  
6. 11 and 15s 7d  
7. 19 and 627

8. 23 and 7  
9. 4s 6d first & 7l 17s 6d last  
10. 42 and 297  
11. 8 and 1572  
12. 15l and 2l 7s  
13. 7 and 420  
14. 384  
15. 1215  
16. 8l 10s 8d  
17. 10l 18s 8 $\frac{1}{2}$ d  
18. 3280  
19. 4095l 15s

## Alligation.

1. 9d. 2. 8s. 3. 7s 9d. 4. 5s 9 $\frac{1}{2}$ d  $\frac{1}{4}$ . 5. 4s 9 $\frac{1}{2}$ d.  
6. 36 { 30 | 4 That is, 4 or rather 2 at 30d, and 6 or 3 at  
40 | 6 40d; or any numbers in the propor. of 2 to 3.  
7. 1, or any equal number of each.  
8. 6 lb. at 9d and 1 of each of the rest.  
9. 1 lb. at 4d, 5d, 6d, and six at eightpence.  
10. 9 gallons at 4s and 7s, and 3 gallons at 6s and 5s  
11. 10 lb. at 4s and 6s, and 20 at 9s.  
12. 18 gallons at 4s and 7s, and 6 g. at 6s.  
13. 18 b. at 7 and 10s, and 6 at 9s.  
14. 12 gallons at 5s, 24 gal. at 5s 6d, and 6 g. at 6s.

*Position.*

1. Suppose 12 to be the number, then  $12 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = 12 + 6 + 4 + 3 = 25$  the result. Then  $25 : 125 :: 12 : 60$ . Ans.  
 Or, suppose the number to be 1, then  $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = \frac{25}{12}$  the result. Then  $\frac{25}{12} : 125 :: 1 : 60$ . Ans. as before.
2. 36/. 3. 36 years. 4. 60. 5. 60 p. 80 ap. 48 pl. 64 ch.
5. First, Suppose the number to be 0, then  $0 \times 2 + 16 = 16$ , but should be 56, therefore the error is 40 too small. Again, Suppose the number to be 1, then  $1 \times 2 + 16 = 18$ , and the error is 38 too small; therefore  $1 \times 40 = 40$ , and  $0 \times 38 = 0$ , then  $(40 - 0) \div (40 - 38) = 20$ . Ans.
7.  $11\frac{1}{3}$  A's,  $11\frac{1}{3}$  B's,  $13\frac{2}{3}$  C's. 8. 15. 9. 35 gal. at 8s, and 25 gal. at 10s. 10. 72 crowns. 11. 12 beggars.

*Duodecimals.*

Ex. 1. 48 6.	Or, $4 = \frac{1}{3}$ 48 6.	Or, 582 in.	Or, $48\frac{1}{2} \times 3\frac{1}{3}$ .
$\begin{array}{r} 34 \\ 1456 \\ 162 \\ \hline 1618 \end{array}$	$\begin{array}{r} 34 \\ 1456 \\ 162 \\ \hline 1618 \end{array}$	$\begin{array}{r} 40 \text{ in.} \\ 12)23280 \\ 12)1940 \\ \hline 1618 \end{array}$	$\begin{array}{r} = 2\frac{7}{8} \times 1\frac{1}{3} \\ = 2\frac{7}{8} \times 1\frac{1}{3} \\ = 161\frac{1}{2} \\ = 161\text{ft}8\text{in.} \end{array}$

- |                                   |                                    |
|-----------------------------------|------------------------------------|
| 1. 540 feet 4 inch. 6 p.          | 20. 4339 ft 4 in. 7 p. 4 th.       |
| 3. 4341 ft 7 in. 7 p.             | 21. 2463 ft 4 in. 3 p. 10 th. 8 f. |
| 4. 966 ft 11 inches               | 22. 5414 ft 9 in. 9 p. 9 th. 9 f.  |
| 5. 8617 ft 4 parts                | 23. 150 ft 2 in. 1 p.              |
| 6. 1279 ft 8 inches 3 p.          | 24. 1182 ft 2 in. 8 p.             |
| 7. 5370 ft 6 in. 11 p. 4 th.      | 25. 3984 ft 10 in. 6 p.            |
| 8. 444 ft 5 in. 10 p. 6 th.       | 26. 37 ft 6 p. 2 th.               |
| 9. 392 ft 10 in. 2 p. 2 th.       | 27. 414 ft 10 in. 1 p.             |
| 10. 671 ft 9 in. 5 p. 1 th.       | 28. 4247 ft 4 in. 1 p. 6 th.       |
| 11. 1036 ft 10 p. 8 th.           | 29. 827 ft 1 in. 2 p.              |
| 12. 819 ft 9 in. 5 p. 2 th.       | 30. 41 ft 1 in. 6 p.               |
| 13. 1048 ft 7 in. 1 th.           | 31. 78960 gallons                  |
| 14. 606 ft 10 in. 7 p. 6 th.      | 32. 517440 gallons                 |
| 15. 557 ft 3 in. 6 p. 4 th.       | 33. 181 ft 6 in. 3 th.             |
| 16. 881 ft 7 in. 9 th. 9 f.       | 34. 302 ft 10 in. 2 p.             |
| 17. 249 ft 9 in. 5 th. 4 f.       | 35. 201 ft 7 in. 4 p.              |
| 18. 4014 ft 7 in. 1 p. 8 th. 8 f. | 36. 288 ft 7 in. 5 p.              |
| 19. 2960 ft 9 in. 4 p. 1 th. 4 f. | 37. 35:5:10:1:3:7:5.               |

*Miscellaneous Questions.*

1. 252408021 5s 4d      97l 2s 6d a sailor's
2. { 88109683200000 her.      66l 12s a marine's
3. { 108110040736 $\frac{3}{8}$  casks 30. 14682l 10s 6d
3. 1s 1 $\frac{1}{2}$ d share 4th class      31. Eldest 460l, second 320l,
4. 62l 14s  $\frac{1}{2}$ d      youngest 180l, wife's share
5. 11l 6s 3 $\frac{1}{2}$ d gain      240l
6. 74l 7s 2 $\frac{1}{2}$ d      32. 1st, 115l 12s 6d
7. { 7604 $\frac{1}{2}$  acr. families      2d, 192l 14s 2d
7. { 1520833 $\frac{1}{2}$  ac. Britain      3d, 269l 15s 10s
8. 92l 15s 8 $\frac{1}{2}$ d  $\frac{3}{4}$       4th, 346l 17s 6d
9. 500 yds 17s 8d sel. price      5th, 423l 19s 2d
10. { 23 13 5 $\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{2}$       6th, 501l 0s 10d
10. { 35 4 2  $\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{2}$       33. A's 8s 2 $\frac{1}{2}$ d
10. { 41 2 4  $\frac{1}{2}$   $\frac{1}{2}$   $\frac{1}{2}$       B's 5s 5 $\frac{1}{2}$ d
11. 3s 2 $\frac{1}{2}$ d  $\frac{1}{2}$  per lb.      C's 4s 1 $\frac{1}{2}$ d
12. 14 $\frac{1}{4}$  gallons      D's 3s 3 $\frac{1}{2}$ d
13. 30l 4s 10 $\frac{1}{2}$ d at 5p. cent. in.      34. E's 440l, F's 880l
14. 2005 $\frac{1}{2}$  lb. cotton      35. 21 min. 40 seconds
15. 8s 8 $\frac{1}{2}$ d  $\frac{1}{2}$  per gallon      36. 170l 13s 11d
16. A. has the advan. by  $\frac{1}{2}$ d      37. 3417l 4s 9d
17. D. by  $\frac{1}{2}$ d and gets 985 $\frac{1}{2}$  y.      38. 1l 8s 10d
18. 1l 6s 7 $\frac{1}{2}$ d gain by keep-      39. 237l 19s 3d
- ing it
19. 7s 9 $\frac{1}{2}$ d      40. { 115l 17s 8 $\frac{1}{2}$ d, directly
20. 2l 5s      { 115l 14s 1 $\frac{1}{2}$ d by Am-
21. 151l 13s  $\frac{1}{2}$ d      sterдам, 114l 14s 1 $\frac{1}{2}$ d
22. 4 cwt 2 qrs 12 $\frac{1}{10}$  lb. at 15d      by France
23. { 7s 1 $\frac{1}{2}$ d  $\frac{1}{2}$  rum      41. 566l 13s 4d directly, 572l
23. { 8s 3 $\frac{1}{2}$ d  $\frac{1}{2}$  brandy      13s 10 $\frac{1}{2}$ d by Hol. 560l
24. 1l 6s 8 $\frac{1}{2}$ d per qr      18s 3d by Paris.
25. Whole may be continued      42. 4l 13s 10 $\frac{1}{2}$ d  $\frac{8}{11}$ d per bar.
- 3 $\frac{1}{2}$  months, and if conti-      43. 10s each
- nued to the end of the      44. 6640 families
- year due 126l 15s      45. 403 ft 8 in. 7 p.
26. 43l 3s 9 $\frac{1}{2}$ d gain      46. 163 feet 7 inches 6 p.
27. 4 months 21 days      47. 65 ft 11 in. 2 th. 3 four.
28. 1cl 2s  $\frac{1}{2}$ d  $\frac{1}{2}$   $\frac{1}{2}$       48. 40 ft 8 in. 4 p. 11 th. 3 f.
29. 669l 6s captain's share      49. 15 ft 1 in. 9 p. 10 th. 1 f. 6 f.
- 492l 2s first mate's, &c.      50. 61 ft 8 in. 9 p. 3 thirds
- 388l 10s second mate's      51. 119 ft 2 in. 4 p. 9 f.
52. 84 yds 3 ft 4 inches